96/125

OVERSIGHT

ALCOHOL FUELS

HEARING

BEFORE THE

SUBCOMMITTEE ON
ENERGY DEVELOPMENT AND APPLICATIONS

OF THE

COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

NINETY-SIXTH CONGRESS

SECOND SESSION

FEBRUARY 22, 1980

[No. 125]

Printed for the use of the
Committee on Science and Technology

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ALCOHOL FUELS

FRIDAY, FEBRUARY 22, 1980

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9 a.m., in room 2318, Rayburn House Office Building, Hon. Richard L. Ottinger (chairman of the subcommittee) presiding.

Mr. OTTINGER. The meeting will come to order.

Today the Subcommittee on Energy Development and Applications will receive testimony on the administration's alcohol fuels program. The President has announced a package of new initiatives that would quadruple the production of gasohol by the end of 1980, and would increase alcohol production to 500 million gallons by the end of 1981. This goal would provide enough ethanol to replace about 10 percent of our unleaded gasoline with gasohol.

In spite of the fanfare associated with this announcement, I have some concerns with just how serious the administration is with its proposal. For example, the DOE Office of Alcohol Fuels is supported by a staff of three. Moreover, the biomass program, which supports research, development, and demonstration of alcohol fuels, has a staff of three professionals managing a $63 million program. Now we find that the Office of Management and Budget has apparent'y denied a DOE request for $30 million in supplemental funds for the Office of Alcohol Fuels.

I would contrast this with what the subcommittee learned on our recent trip to Brazil. We were able to witness firsthand their commitment to reduce dependence on imported oil. They have implemented an aggressive program to substitute alcohol and other renewables for petroleum-based transportation fuels. By providing a variety of incentives the Brazilians have been able to increase their production from 0.6 billion liters to 2.5 billion liters in just 3 years. Certainly the United States, with its vast technical and agricultural resources, could make an even greater reduction in our imports if we followed an equally aggressive program on a diverse number of alternative energy sources, such as alcohol.

In today's hearing we will focus on the Federal role in alcohol fuels research, development, and production. We would like to know what role the new Office of Alcohol Fuels will play within the Department of Energy. I am interested in hearing how the office will interact with the biomass program and who will have responsibility for research and development of alcohol systems. We have Dr. Bennett Miller here to discuss this with us. I am also interested in activities of the Department of Agriculture. So, I am

pleased to welcome the Deputy Secretary of Agriculture, Jim Williams. We will also receive testimony from a distinguished panel of industrial, agricultural, and technical witnesses who will discuss research, development, and demonstration needs the committee should consider in reviewing the DOE budget request in this area, as well as the proper role of the agricultural sector in successfully achieving the goals of the announced alcohol program.

If we are going to enter into an aggressive alcohol fuels program, there will be a need for planning the kinds of plants to be used for fuels; and the need to work on distillery construction. There is a need to tie in the transportation systems; a need for research and development on new materials for feedstocks for fermentation, so there would be a continuous supply of alcohol products not dependent on the weather or good and bad crop years.

There is a good deal going on in Brazil. They are starting to use wood to get ethanol and methanol. We apparently dropped acid hydrolysis in this country and are emphasizing working on enzymatic hydrolysis. Advanced hydrolysis systems certainly is a subject we would like to take a look at in these hearings.

Finally, I would like to extend a warm welcome to Senator Birch Bayh, chairman of the National Alcohol Fuels Commission. He has been a vigorous supporter of this program. He will review the activities of the Commission and give the subcommittee valuable recommendations and advice on the actions we should take on the budget request for the Office of Alcohol Fuels.

It is a matter of real distress that the Departments of Agriculture and Energy have not yet reached agreement on alcohol fuels and biomass. One of the things we want to do is find out the problems and see if we cannot spur the two departments to get together effectively in a coordinated and integrated program.

Senator, we are very happy to have you with us. We will be glad to receive any materials that you might have for the record.

STATEMENT OF HON. BIRCH BAYH, A SENATOR FROM THE STATE OF INDIANA

Senator BAYH. Mr. Chairman, it is a privilege to be here with you as a colleague and friend this morning. I appreciate the courtesy you have extended to me as Chairman of the National Alcohol Fuels Commission, by inviting my testimony. Could I also ask that Sharon Peterson, one of the NAFC Public Commissioners, join us here?

Mr. OTTINGER. We would be glad to have her.

Senator BAYH. She is part of the mix of Members of the House and Senate and public representatives who comprise our Commission. And she has a very active interest in pending developments and legislation that affect alcohol fuel development.

We expect our public members to make a major contribution to our work by anticipating some of the bottlenecks that producers face and suggesting how they ought to be overcome. Ms. Peterson has long been one of those in the private sector interested in alcohol fuel development—a real leader—as a farmer and consumer.

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The president of the American Automobile Association, Jim Creal, is another member, as is Serge Gratch, a top research official with Ford Motor Co.

Let me, Mr. Chairman, at the risk of succumbing to the Senatorial temptation to go off at length, and in order to avoid extemporizing a 5-minute statement into 15, just go through my prepared remarks.

Mr. Chairman, I very much appreciate the opportunity to be here today to discuss with you what I see as the challenges and opportunities facing this country with respect to alcohol fuels.

As you know, this Nation continues to be heavily dependent on costly, foreign and insecure sources of petroleum. I was thinking the other day as we were taking inventory as to what I could do this year to better serve the country, that there are very few domestic and international problems that do not ultimately stem back to our energy problem. I think the significance of your work and what brings us together this morning, is important. Fuel prices continue to skyrocket, with gasoline now reaching approximately $1.20 a gallon and above. The inability of this Nation to meet its growing energy needs with a secure and dependable source of domestic fuel is a problem that can only continue to erode our economic vitality and threaten our national security.

We know that the Nation's energy needs can only be met by a persistent and aggressive effort to stimulate a broad range of alternative sources of energy. Alcohol fuels are one alternative energy source that can make a contribution to extending our fuel supplies. I have long been a confirmed alcoholic—from a gasohol standpoint. Alcohol fuels are not a panacea for all our problems, but significantly they are the only near-term alternative to commercially produced liquid fuels available today. And that will continue to be true over the next few years, as much as we hate to admit it.

Alcohol fuels can be produced from a broad range of renewable resources available in this country, including not only grains, but waste materials from food processing plants, surplus or distressed crops, sugar crops and others. In the longer term they can be produced from cellulosic waste materials, including municipal solid waste. Alcohol fuels have tremendous potential to enable this Nation to convert urban and agricultural waste materials into much-needed liquid energy supplies. Right now the group most excited about alcohol fuel is the farmers. But over the horizon, we will see one of the major problems confronting our cities—waste—turned into a valuable resource that can supplement our current liquid fuel supplies.

Alcohol fuels work, and can be successfully utilized in a number of major end-use applications. Our major emphasis has been on transportation. But alcohol fuels can also be used as a fuel for utilities, as a feedstock for the petrochemical market, in onfarm vehicles, and even as an additional home heating fuel.

Alcohol fuels technology is commercially available today—I want to emphasize that, today—and new plants, designed for fuel grade production, can be optimized for improvements in cost and energy efficiency.

Alcohol fuels can be produced to achieve a net gain in liquid fuel, even when the energy in the growing, harvesting, and production is

accounted for. Sources other than petroleum or natural gas can be used as a power source for the alcohol production facility, which will increase the energy balance picture. One of the early reports the Commission will release deals with the old bugaboo that there is a net energy loss in the production of alcohol. The Archer-Daniels-Midland plant, the most sophisticated alcohol-producing plant in the United States, as you know, Mr. Chairman, produces almost all of the alcohol fuel used in the country. Their process has been certified by DOE as having a positive energy balance. I think more of these facilities will be on line in the near future.

Alcohol fuels, particularly gasohol, are selling competitively in the marketplace today with high-octane premium fuel. As world oil prices continue to rise, the price of alcohol will continue to be even more attractive.

Alcohol fuels can be produced on a regional, decentralized basis, to serve the needs of local communities, urban areas, and farm areas. Alcohol can be produced by farmers for their own use in farm-size stills, or by large producers for commercial sale.

Just in the last year there have been a number of major developments in the growth of this industry. I thought it might be helpful just to touch on the highlights of those.

Gasohol is being sold at over 2,000 outlets nationwide. In talking to many of the service station operators who sell gasohol, it is not uncommon for 50 percent of the sales to be gasohol. Some dealers I have talked to indicate as much as 70 percent of their sales are gasohol.

There is a growing public knowledge and acceptance of the product as a high-quality, high-octane motor fuel. In a recent Louis Harris survey Americans indicated their strong preference for gasohol over other synfuels. Forty-seven percent of those polled were willing to pay higher prices for gasohol over gasoline. There is something very American about pulling up to the gasohol tank and sending the Ayatollah and others a message.

Nineteen oil companies have initiated test marketing programs to sell gasohol under their own brand names, and are now expanding their distribution because of favorable customer response. Jobbers and service station dealers are anxious to participate in this endeavor.

The major auto companies have announced that new car warranties will be extended to apply to gasohol.

That is where we are. This all has not come easily. But I think we have moved along very well.

So, Mr. Chairman, we have a growing market for alcohol fuels, but are faced with constraints on expanded sales due to lack of production capacity. What we have is a chicken-and-egg situation: With potential producers ambivalent, although less so, about investing in production facilities because of uncertainty about market potential; and limited sales because of limited alcohol production.

To my mind, the key policy question, then, is how to break out of that circle and how to do that as efficiently and aggressively as possible.

READEX FICHE

The major constraint to alcohol fuels today is production capacity, not the availability of raw material supplies to convert into alcohol fuel, not inability to know how it is done, or the lack of technology. We can improve in all these areas and will, I predict, in the next generation of alcohol-producing facilities. But if we are to increase the role that alcohol fuels can and must play in our energy future, we must dedicate ourselves to a strong commercialization program intended to stimulate more widespread production of alcohol fuels.

The Federal Government must provide the certainty of a long-term market for alcohol fuels to get this infant industry off the ground. It also must provide financing and technical assistance to producers having problems securing capital or who need technical assistance to construct such facilities. Furthermore, we must remove much of the Government redtape surrounding application procedures for Government permits to operate facilities, and for obtaining financial assistance. We must streamline Federal regulation pertaining to alcohol fuels, so that such regulation assists rather than impedes the development of this industry.

My office has worked over the last year with the Treasury Department and they have cooperated, I must say, to try to make sure the regulations designed to prohibit bootlegging do not interfere with alcohol fuel production. The way those regulations were being implemented made it almost impossible to get into smallscale farm production. But provisions to simplify Bureau of Alcohol, Tobacco and Firearms Regulations were included in the windfall profit tax bill and should soon be law.

I, along with other Members of Congress, have taken steps to introduce and cosponsor legislation to stimulate the development of alcohol fuels, and to remove barriers to its development.

The amendment I sponsored in the Senate along with Senator Dole, as part of the Windfall Profit Tax Act, to extend the Federal excise tax exemption, and simplify Federal regulations for production and denaturing, has been retained in modified form by the conference. This is—I want to emphasize—this is probably the single most critical step we could have taken to attract private capital, by providing strong market security for potential producers—the single most important step. This has been repeated over and over to me as I have talked to persons with large amounts of private capital to invest—the ADM's, the Staleys, the Anheuser-Busches, those folks with a lot of private capital. They say it is the one step that can get this industry off the ground. There are corporations formed now, ready to move into the marketplace, literally within a matter of weeks, once this matter is resolved. I know we have a problem with certain other interests in the Congress. I have been one who has been willing to help. But now I find myself in an adversary position, with some arguing that the sanctity of the Highway Trust Fund is more important than getting a gasohol program underway. I say we have to get the sheiks and the ayatollahs off our back. As soon as we get this resolved, I pledge, as one Senator who happens to sit on the National Alcohol Fuels Commission, and chairs the Senate Transportation Appropriations Subcommittee, to assist in putting together a program to assist both the Highway Trust Fund and alcohol fuels. When I see some-

thing so close, Mr. Chairman, the one most important gasohol incentive we have, I cannot let it die. We are operating here within a weekend time frame. This matter of retaining the extension of the exercise tax exemption for gasohol will be resolved in the House next Tuesday and then in the Senate shortly thereafter. We must not kill the extension.

In addition, provisions I sponsored with Senators Church and Johnston in the Energy Security Act provide financial assistance in the form of purchase agreements, loan guarantees, and price supports for alcohol fuel producers. I hope these will be retained by the synfuels conference.

I am personally encouraged, let me say, by recent signals from the administration that demonstrate growing support for the development of alcohol fuels, and an acceptance of this fuel as an important near-term alternative. While the DOE's Policy Review set the stage for Federal support for alcohol fuels, the commitment by the President and Secretary of Energy Duncan to set specific production targets of 500 million gallons of alcohol by 1982 is a dramatic and positive step forward in stimulating new supplies of alcohol.

I have personally met with Secretary Duncan on a number of occasions, and am enormously heartened by his obvious and no-nonsense commitment to an alcohol fuels program. We have to make sure he has the resources and organization to do the job, and your committee can play a key role here. I want to emphasize that personal commitment alone is not going to do the job. It takes resources and an organization, and an reorganization not doomed to fail because it cannot compete with others in the Energy Department.

DOE ALCOHOL FUELS OFFICE

As you know, Mr. Chairman, the Department of Energy has recently moved to establish a new Office of Alcohol Fuels. I have been a strong proponent of the need for the DOE to establish a central focal point within the Department to serve to coordinate and administer alcohol fuels programs. In fact, I testified before DOE's policy review over a year ago to this effect. More recently, I sponsored legislation, that I mentioned a moment ago, along with Senators Church and Johnston, title III of S. 932, which would establish an Office of Alcohol Fuels within DOE, reporting to the Secretary, and responsible for administering $1.2 billion dollars in funding obligations—$400 million of outlays—for alcohol fuels production and commercialization.

However, the office recently established by the Secretary in my judgment, does not provide the high-level resources or emphasis necessary to carry out a strong commercialization effort. I say this not as a personal criticism of the Secretary. I have discussed this shortcoming with him directly. I think it important that we not have a system doomed to failure because it cannot compete with others and does not have a good foundation in the Energy Department.

Let me point out where I think the weaknesses are.

First, and key, the DOE office, unlike that in S. 932, does not have direct responsibility for alcohol fuels commercialization. This effort would be left with Resource Applications, where alcohol fuels

will be a neglected child compared to other fuels with stronger intradepartmental support. I think it is important for us to establish a structure to give alcohol fuels the institutional support such that they command attention—the "squeaky wheel" theory we are all familiar with in the political process.

Second, the Office of Alcohol Fuels, as proposed, will report to the Assistant Secretary, Conservation and Solar Energy, through the Deputy Assistant Secretary, Solar Programs.

I have nothing personal against these gentlemen, but the organizational structure propose does not provide a straight pipeline to the Secretary.

Just as an aside: I understand the Secretary has assigned his good right arm, assistant Steve Potts, to run that office on a temporary basis. If we were to have someone like Steve Potts running that office on a permanent basis, I would not be as nervous as I am. If we could get it established as an independent office, with Mr. Potts the permanent head, we would have a Manhattan Project approach, because I think he is an outstanding guy. DOE has tried to hire other people, but has not been successful. Part of the reason they cannot get top-notch administrators in there is because of the location, the secondary or tertiary level of the office in the bureaucratic structure.

In order to carry out a meaningful national program, the Alcohol Fuels Office must have higher visibility within the Department. In our legislation we made it responsible directly to the Secretary.

Third, the proposed Office of Alcohol Fuels does not yet have an operating budget at this time, and will be staffed at a level of about 15 people. A supplemental budget request by the Department of Energy to OMB for $30 million was denied.

I have to say that this is a disgrace when alcohol production is the one way we can increase fuel supplies and reduce the amount of oil we ship through the Straits of Hormuz. We must either make a major commitment, Mr. Chairman, or admit we are not pursuing this option.

Finally, the Alcohol Fuels Office was assigned to work with the Assistant Secretary for Resource Applications with respect to funds appropriated to the Department for Alternative Fuel Production in the fiscal year 1980 Interior Appropriations bill. While the Alcohol Fuels office is charged to coordinate with other existing program elements, I am concerned, Mr. Chairman, by the fact that the only commercialization effort in the Department for alcohol fuels is not centralized in the Office of Alcohol Fuels. I see no indication that the fragmentation between various alcohol fuels programs which has existed for such a long time in the Department is being remedied, although the new Office is a positive step forward.

PUBLIC LAW 96-126 FUNDS FOR ALTERNATIVE FUELS

I am equally concerned that the only funding for alcohol fuels commercialization in the Department, as provided by the fiscal year 1980 Interior Appropriations bill continues to place alcohol fuels in competition with other synthetic fuels. While alcohol fuels projects are eligible for such funding, it is clear to me we need to dedicate resources specifically to alcohol fuels, if we are to meet the President's near-term production goal. Through at least 1985

alcohol fuels are the only—I hate to keep coming back to that, but they are the only game in town, the only near-term option we have to extend this country's liquid fuel supplies. This effort should not be commingled with others. Now is the time to move in the short term with alcohol.

FISCAL YEAR 1981 BUDGET

I am equally concerned by the low level, lack of emphasis, and allocation of funds for alcohol fuels in the fiscal year 1981 budget. The DOE has requested $14.6 million for outreach and development of ethanol from biomass out of a total DOE budget of $12.6 billion. Of this total, about 80 percent or $11.6 million is to increase production of trees and herbaceous and aquatic plants. So even that money is not being geared to near-term results.

It seems to me that this alloction of resources ignores the key question that should be asked with respect to research and development programs: How can we get the greatest payoff in more efficient and lower cost production for the money we spend?

One of the most promising areas for alcohol fuels development will be the commercialization of technology able to convert cellulosic waste materials into alcohol fuels. I mentioned this a few moments ago. We are just about to move out; in fact, we have granted one research project of a pilot commercialization size. While that technology is nearly here, the DOE budget provides a mere $2.5 million in support of cellulosic conversion technology development. I do not want to make light of $2.5 million, but progress in this area of converting cellulose into alcohol is critical to supplying future liquid energy needs adequately and economically. In addition, there needs to be further emphasis on the development of new energy crops, and harvesting and crop drying equipment, which will further improve the economics of alcohol fuels.

Further R. & D. work needs to be done on the utilization of byproducts of alcohol fuel production. Byproduct credits are critical factors in the economics of alcohol. Consequently, as we push forward on a more extended alcohol program, we should be looking for alternative ways of utilizing those products. We are sitting here with 10 million tons of corn because of our effort to get the message to the Soviet Union. That ought to be a blessing. We now have a good, solid pool of feedstocks. Frankly, Mr. Chairman, although this may sound harsh, I do not care if we do not ever sell the Soviet Union another bushel of corn. We ought to be running all the corn we can through our distilleries, taking the protein out of it, and then selling the byproduct to nations in need of animal feeds. Those are the kinds of problems we all need to work on.

TECHNICAL ASSISTANCE

Another key area that holds great potential for this country is the construction of small-size stills by individual farmers or farmer cooperatives who produce alcohol fuels either for their own use or for commercial purposes. In developing an alcohol fuels policy we must encourage small-scale technology and production as well as large-scale, commercialized plants, to meet our farmers' needs for secure supplies of liquid fuels over which they have some control.

We have literally hundreds of thousands of eager, interested farmers, many in town this week—I understand one or two will testify about this, this morning, and they will tell you more about this than I can—who want to produce alcohol but need to know where they can go for accurate, reliable technical information and assistance. DOE needs to do a much better job in this area, and I am hopeful we on the Commission can provide some of this assistance.

ROLE OF METHANOL

Because the goal of an alcohol fuels program is to displace petroleum, I think it is important that alcohol be defined in the generic sense. While ethanol is the only liquid fuel that can be brought on line right now, methanol from coal and municipal and industrial wastes can play a significant role over the longer term. We should not let the opportunity for developing other types of alcohol, such as methanol, which have longer lead times, go by the board. This will enhance the capability of our Nation to supplement fuel supplies, and to expand the raw material base for alcohol fuels over the longer term.

END USES

As we look to the future, it is also important for this Nation to broaden the use of alcohol, both ethanol and methanol, beyond the transportation sector. And our Commission is looking into this. It would be a mistake to envision that gasohol is the only form of alcohol which can make a contribution to extending our energy supplies. The technology for utilizing 100-percent alcohol in vehicles is here today. You know that from your experience in Brazil.

Automakers such as Ford, General Motors, and Volkswagen are already producing vehicles designed to run on pure alcohol in Brazil. However, the marketing of pure alcohol vehicles in t' United States is constrained by the lack of an assured supply c alcohol.

It is vital that we move ahead aggressively and take the necessary steps to enhance our Nation's capability to produce alternative fuels, including alcohol fuels.

Mr. Chairman, in conclusion I would like to say to you and other members of the Commission—I see two of our good right arms, Mr. Blanchard and Mr. Glickman—I would like to say that I think we are really at a crossroads. We can either move ahead aggressively now to provide the kinds of incentives and programs that are necessary to insure that we develop this promising new energy source, or we can continue to footdrag on achieving these goals and targets. These are the opportunities and challenges we face. I would be more than happy to cooperate in any way, as chairman of the National Alcohol Fuels Commission, and one U.S. Senator, as your committee discharges its responsibilities in this area over the coming months.

As I see it, the 500-million-gallon target which the President has set can be reached. It is only a first step in a longer process to enable alcohol fuels to develop their maximum potential. I feel we can achieve far greater production levels as we begin to bring on line new alcohol fuel capacity and develop the technologies that will allow for a broad-based supply of feedstocks. But we must get

off the dime and on with the job. This will require adequate organization, resources, and clear commercialization goals.

The technology is here. Let us get it on line as we move toward second generation technology.

Mr. Chairman, you have been very kind. I get rather enthused about this. I feel this is an opportunity; the time is here. Few Members of Congress have ever had a chance to meet a major national-interest challenge as we have now.

Mr. OTTINGER. Thank you very much for your excellent statement today. This subcommittee, as you can see by the attendance here, shares your concern and outrage that the administration is slow in moving on this.

We were informed you had to leave by 9:30, and it is now 9:37. Can you stay or must you go?

Senator BAYH. Unfortunately, I have a commitment with my constituents, but I thought this opportunity was so significant that I would risk traveling at an uncomfortable rate of speed between here and Washington National.

Mr. OTTINGER. We will invite Mr. McIntyre here. There are so many instances in which the administration's pronouncements are good and their actions are totally disparate from their words.

Just let me ask you one question: The administration and Congress are going to be considering a diversion and set-aside program. What do you think of the idea that has been championed by Pincas Jawetz, who is here this morning and has been helpful to both our committees, of taking that money and putting it into distillery production instead of new diversion of lands not to grow crops?

Senator BAYH. Frankly, I do not think we should have to get money for commercialization that way. Let me suggest another idea instead: Establishment of an energy security reserve, an energy independence reserve. I am going to introduce legislation next week, drafted with the assistance of Purdue University, to get the 10 million tons of embargoed corn off the market and to let farmers plant those set-aside acres for gasohol insisting the Secretary use the authority he now has. So instead of paying the farmers not to produce, which they do not like and you do not like, I would have them producing and selling that into the alcohol energy independence reserve. Right now we cannot use all the corn we can produce. We need to emphasize increased alcohol fuel production capacity now. In a couple or 3 years, that production will go up geometrically. In about 2 or 3 years from now, if we retain the excise tax exemption extension, the 4-cent tax relief, we are going to see production zoom. If, in the meantime, we have established the energy independence reserve for alcohol, it can meet increased production needs while we bring cellulosic waste technology on line. We have a very important time factor here. The problem is, if you do not have the set-aside and farmers do not have a market for that grain, they will have excess production, which will depress prices. So, I would get those surpluses off the market. The Secretary is very concerned about food and fuel needs conflicting. The Commission will have a report to lay that to rest. But, given our energy needs, it is unintelligent that farmers are being paid not to produce.

I give the mace to brothers Blanchard and Glickman because I cannot miss that plane. I apologize for leaving prematurely, but anything I can do, in cooperation with you, I will. We do not have any magic solutions, but must all work together. I am glad to see a committee like this out there leading the charge.

Mr. OTTINGER. We will do everything we can to join you in your effort to make this a reality.

We next have a panel consisting of Don Patterson, American Agricultural Movement; Dr. Ralph Frederickson, Katzen Engineering, Cincinnati, Ohio; Dr. John Radovich, Department of Chemical Engineering, University of Oklahoma; and Ladd M. Seaberg, general manager and vice president, Midwest Solvents, Inc., Atchison, Kans.

Without objection, we will include the full statement of all the witnesses in the record. If you could summarize, it would help the committee, and we would have more time for an exchange.

We will start with Mr. Patterson.

STATEMENTS OF DON PATTERSON, AMERICAN AGRICULTURAL MOVEMENT; DR. RALPH FREDERICKSON, KATZEN ENGINEERING, CINCINNATI, OHIO; DR. JOHN RADOVICH, DEPARTMENT OF CHEMICAL ENGINEERING, UNIVERSITY OF OKLAHOMA; LADD M. SEABERG, GENERAL MANAGER AND VICE PRESIDENT, MIDWEST SOLVENTS, INC., ATCHISON, KANS.

STATEMENT OF DON PATTERSON

Mr. PATTERSON. Thank you, Mr. Chairman. As you are aware, I had the opportunity to testify before the committee in June. Most of my viewpoints and data were submitted for the record at that time. However, some aspects need to be emphasized.

In June, when we were working on this issue, the synfuels program was working its way through the Congress. One Congressman said at that time the mood of the American people was to "do something," even if that something was wrong. We have the opportunity now, with alcohol fuels, to do the right thing. The need is great to get the administration, the Department of Energy, and particularly the Department of Agriculture moving on this issue.

In the 1950's, one-half of a billion dollars was spent annually on nuclear reactor research alone, not to speak of other subsidies to the nuclear industry. We are only beginning to realize now what a poor priority for expenditure of public funds that was.

The biomass energy program (along with other related solar based technologies) is much more promising, worthy, and deserving of such expenditures. If we could obtain as large a subsidy as the nuclear industry has had, there is no question what we could do. Our major problem at present in the area of biomass energy is to form the capital necessary.

With the benefit of hindsight, we conclude that the nuclear approach has been a monument to human greed and to the desire to centralize economic control within our system. When we study all the risks, externalities, safety hazards, and hidden costs, we see now that nuclear is less than the most efficient way to produce needed energy. It is simply the technology that enables the greatest concentration and market control to those who own the produc-

tion functions. In contrast, the alcohol fuel and biomass approach gives us an opportunity to reestablish the kind of decentralized control and competition within our economic system that our forefathers envisioned. From my point of view, it is a blessing from heaven that we should have momentary reprieve at this time to show what can be done with this renewable technology.

When the economies of scale in alcohol production are fully evaluated, we see that the most efficient place to make alcohol is in relatively small farm and community scale plants. The cost of obtaining the feedstock resources and the opportunity to feed the mash wet without the energy costs of drying and hauling result in net energy benefits that are substantial. This is not to say that there is not a scale of plant that would be too small. The Secretary of Agriculture is correct when he says that backyard stills are not economically feasible. But the implication of his statement that alcohol production must occur in large scale plants does not follow, and USDA action giving all of the early congressional alcohol fuel appropriations to large operators was decidedly uncalled for. A plant must be large enough to be able to pay its labor costs, but in the future as technological steps are taken to improve the automation of plant controls and thus labor costs are reduced, even smaller plants may well be feasible.

Repeatedly, we have heard it argued that it takes more energy to produce 1 gallon of alcohol than the alcohol itself contains; I hope that we can finally lay this issue to rest. We have alcohol plants operating on American farms now which document energy input of less than 20,000 Btu per gallon. That result is a highly favorably net energy balance, when you consider that there are 87,000 Btu in a gallon of alcohol and we have not yet completed all the steps possible in the effort to reduce the energy input. We have not, for example, introduced solar process heat into the system. Nor have we introduced various passive solar techniques which can be helpful. We have not even fully exploited all the possible methods and opportunities for heat exchange within the system, even though the net energy benefits achieved so far have resulted entirely from the use of proven and well-established industrial heat exchange technology.

The opportunity to recycle heat within the system through the use of heat exchange techniques is indeed proving very valuable in achieving net energy benefits in onfarm alcohol production. The problem is that the implementation of these techniques and the further implementation of solar opportunities carry a high front-end cost which is very difficult to sustain when the capital resources available to farm and community scale alcohol producers are so limited under the current economic situation.

We simply do not have the capital available in rural America. At present, we have $160 billion of net farm indebtedness in this country, and it takes $14 billion as against $30 billion of what that USDA calls net farm income just to service this staggering agricultural debt load. Our rural bankers have expressed the fact that they do not have money to lend at any interest rate, even if we could afford to pay the interest rates that are now being charged.

The Federal Reserve bank has even expressed glee that it has the means in hand for throttling down inflation. For too long they

have tried to control inflation using interest rates as the sole implement. In effect, they are choking the farm economy and making rural Americans pay even more than others have to in the fight against inflation. This approach actually causes more inflation, for those that have the market leverage will simply pass on their higher interest costs and those that do not have the market leverage will collapse to be taken over by those that do have the leverage. Thus, the trend toward ever-increasing concentration of ownership and control within our American system continues inexorably under present management.

The only way that we will restore health to our economy is to restore productive capacity and earned income to our system again from the bottom. We have only to look at our own history to know that a healthy agricultural economy underneath our entire system is capable of lowering our unemployment rate, lowering our rates of inflation, and giving us a healthy balanced economic growth as well as enough income throughout the system to balance the Federal budget. In fact, we have balanced the Federal budget only in those years when agricultural income has been robust. In addition, the restoration of income to agriculture is the only means that we can form and maintain the capital base necessary to enable farm producers to build and sustain the alcohol production facilities and other biomass energy alternatives which, integrated with their other farming activities, can help to stabilize the farm economy and protect the economic strength of our most efficient food producers.

If American farms were in a strong economic position at the present time, we wouldn't need to depend so heavily on Federal initiatives to launch the alcohol fuel program. As a result of the way Federal commodity policy has been managed over recent years, American farms are in a syndrome of dependency, unable to rely on their own resources to develop new opportunities, but are instead totally dependent on credit opportunities and other related program initiatives advanced by the Federal Government.

Even though the formulation of Federal policy toward alcohol fuel has advanced remarkably over the last year, there are still many detractors and many issues that have to be confronted in order for this technology to show its true promise and for the truth to be sorted out from the fiction. One of the areas of particular concern to many is the potential for food-fuel conflict. In that regard, we need once again point out that alcohol is actually the byproduct of a process which makes agriculture more efficient and that the food nutrition of the grain is actually improved in the process of making alcohol. This is not to say that in the years ahead we may not have to deal with potential food-fuel conflicts, but right now we actually have the means of improving the efficiency of agriculture and helping to rebuild the entire fabric of our rural economy from the grassroots as we implement an alcohol fuel program. A more lengthy statement on this issue was in my June testimony, and I will simply refer to that document at this time, rather than to go further into the details.

Another issue which has been raised is the plant construction lead time. In April of last year, under the direction of Dr. Paul Middaugh of South Dakota State University, we built an alcohol

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fuel still and demonstrated it on the mall. In 3 weeks' time that plant was built, transported from South Dakota, and erected for operation on the mall. It was demonstrated in operation for a period of several days. The scale of plant constructed on the mall was suitable for average farm size production, approximately 20 gallons per hour, and there is no question about our ability to build plants of that size on farms or cooperatively across rural America. Our problem, once again, is the ability to form the capital and also in part the ability to accomplish the educational job necessary so that farmers and others can operate the facilities once they are built. There is absolutely no way that larger scale plants can come close to this timetable, although there is one other caution I would like to state. The plant demonstrated on the mall was simply basic still. From my point of view, the construction of the basic distillation columns constitutes about 10 percent of the total construction task of an efficient alcohol plant. The job of building and installing the heat exchange systems, the enzymatic treatment, fermentation, yeast maintenance and mash treatment facilities, and the final alcohol drying facilities are by far the largest part of the total task to be performed. I would like to note in this regard the eminent work of Dr. Eugene Schroeder of Campo, Colorado.

In conclusion, there is simply no way that large scale plants of the type that seem to be preferred by the Secretary of Agriculture can accomplish the objectives set before us by the White House. The job can be done on the farms and in the rural communities, and we can rebuild the economy of this country from the grassroots if we will make the commitment. In this regard, the $3 billion committed for loans and the $300 million committed for farm scale plants is precisely skewed upside-down. The 90 percent should be for farm and community scale plants, as that is the efficient place to make alcohol, and the 10 percent should be for trial operations by larger operators. If the larger plants can prove themselves in relation to the economies achievable by the smaller scale plants, in most cases they will have sufficient access to capital markets to finance their own operations without Federal assistance. Assistance needs to be provided to those that have over the years been squeezed so desperately by Federal agricultural policy. For the sake of our own future, for the future of our most efficient agricultural producers, and for the future of our energy supply, it seems to me absolutely essential that we proceed with a vigorous program of small and decentralized alcohol production facilities. We must still face other related problems in the years ahead, but, considering all the alternatives, this is the only alternative which we reasonably have at the present time if we are to reduce our dependency on foreign oil.

It has become tiresome to hear political leaders in this administration grandstand on the alcohol issue when there are political benefits in doing so, and then quietly scuttle the plans afterward, failing to follow through on the political commitment. The spokesmen and the actions of the administration when they fail to follow through on these commitments need to be exposed so that we can see that action is taken. There is no excuse for further delay; we have delayed too long already.

[A biographical sketch of Dr. Frederickson follows:]

RALPH E. C. FREDRICKSON, Chemical Engineer, P.E., Senior Partner

Dr. Fredrickson holds degrees of B.Ch.E. and M.S. from the University of Minnesota and a Ph.D. from Columbia University. He has 41 years of research, development, and engineering experience in the process industries, including organic chemicals, fertilizers, grain processing, kraft and sulfite pulping, petrochemicals, synthetic fuels and fermentation.

Dr. Fredrickson was previously associated with C&I/Girdler, Inc. as Commercial Director, with Stepan Chemical Company as Associate Director of Corporate Development, with A. E. Staley Manufacturing Company as Director of Engineering Research, and with Du Pont and the Minnesota and Ontario Paper Company as a chemical engineer.

Since 1969, Dr. Fredrickson has been a consultant to the chemical process industries, with Raphael Katzen Associates.

He is a registered Professional Engineer in Illinois and is a member of the American Institute of Chemical Engineers (past Chairman of Central Illinois Section) and the American Chemical Society.

STATEMENT OF DR. FREDERICKSON

Dr. FREDERICKSON. Thank you, Mr. Chairman. We certainly do appreciate the opportunity to say a few words on the development of alcohol from waste.

I brought two speeches with me, but in the interest of the question period I will give you the short one, and it will be very short.

The University of Arkansas cellulose to alcohol process is aimed initially at converting two waste materials, pulp mill waste and the paper fraction of garbage, into ethyl alcohol. The process as it now stands is the result of 9 years of laboratory and pilot plant research, financed until recently by Gulf Oil Chemicals and currently by the Biomass Research Center of the University of Arkansas. The director of that effort is Dr. George Emert. The total research investment to this point is in the range of $7 million. Raphael Katzen Associates International, Inc., of Cincinnati have served, and continue to serve, as engineering consultants to this research effort.

The conceptual process that has emerged is illustrated by the block diagram—let me briefly tell you what happens. It is assumed that this particular alcohol plant will be located across the fence of a municipal solid waste processing plant which has the capability of separating the paper fraction from garbage. This will be pneumatically conveyed to the site. Pulp mill waste will be trucked in and these two materials then become the raw materials for the production of alcohol.

Now a portion of the raw material in section 200, serves as the food for the organism that generates the enzyme in section 300. The enzyme broth is then fed in its entirety into section 400 where it joins the remainder of the cellulosic waste. Yeast is added and the mash converted to ethyl alcohol. From that point on the process is conventional. The dilute alcohol goes through a system of distilling columns to produce, in this particular design, approxi-

mately 73,000 gallons per day of anhydrous alcohol, suitable for blending with gasoline, plus 75,000 gallons per day of high-grade industrial alcohol. With a minor design change and some decrease in investment, the entire alcohol output could be in the form of anhydrous alcohol.

Figure 2 is an energy diagram for the plant indicating overall thermal efficiency of 50 percent.

The plant produces two byproducts: a protein-rich syrup that shows some promise as a constituent of animal feeds, and a solid residue that is burned to supply a portion of the energy requirements of the plant.

The estimated capital investment, assuming 1981 costs, is $112 million, as shown in table 1.

To achieve a 15-percent after-tax return on the $112 million investment, the required selling price is $1.44 per gallon in 1983. The current selling price for alcohol is in the range of $1.70 per gallon.

Table 3 is our estimate of the required selling prices of alcohol from cellulose, ethylene and corn for er pound as compared with about 21 cents today. The figures for corn were based on $3 per bushel.

In figure 3, which you have before you, we show the alcohol selling price for 15-percent return after taxes as affected by plant size.

Figure 4 shows a set of economic projections for alcohol plants up to 1993.

The problem now before us is to confirm the technical and economic performance of the Arkansas process for the conversion of cellulosic wastes to alcohol. Toward that end, a 50 T/D demonstration plant has been designed. If funds were available, the purchase of equipment could begin immediately. Site negotiations are in an advanced stage. When these are finalized detailed engineering could begin immediately.

The estimated investment for the demonstration plant is $19.5 million, including a 15-percent contingency and a $5.5 million allowance for possible plant modifications. The estimated operating cost for 2½ years' operation is $13 million, giving a total cost of $32 million for the program. If we are successful in operating the plant at 65 percent of design capacity, the alcohol credit of $4 million reduces the operating cost figure to $9 million. This gives us $28 million as the cost of the program as we now visualize it.

Thank you, gentlemen.

[Tables 1, 2, 3 and figures 1, 2, 3, 4, follow:]

TABLE 1

2000 T/D COMMERCIAL PLANT INVESTMENT (1981 COSTS)

50 MM USGPY (190° PROOF) ETHANOL

	1981 $ MM
SECTION 100 - RAW MATERIALS RECEIVING & STORAGE	8.95
200 - RAW MATERIAL PREPARATION	11.65
300 - ENZYME PRODUCTION	8.34
400 - SSF	16.80
500 - ALCOHOL RECOVERY	10.42
600 - WASTE LIQUOR (FEED MOLASSES) & CONDENSATE TREATMENT	13.98
700 - GENERAL FACILITIES & OFFSITES	27.46
TOTAL INSTALLATIONS	$ 97.60
15% CONTINGENCY	14.60
TOTAL INVESTMENT	$112.20

TABLE 2
OPERATING COST AND SELLING PRICE ESTIMATES (1983)
BASE CASE - WITH ENZYME RECYCLE
50 MM U.S. GALLONS/YR PRODUCTION

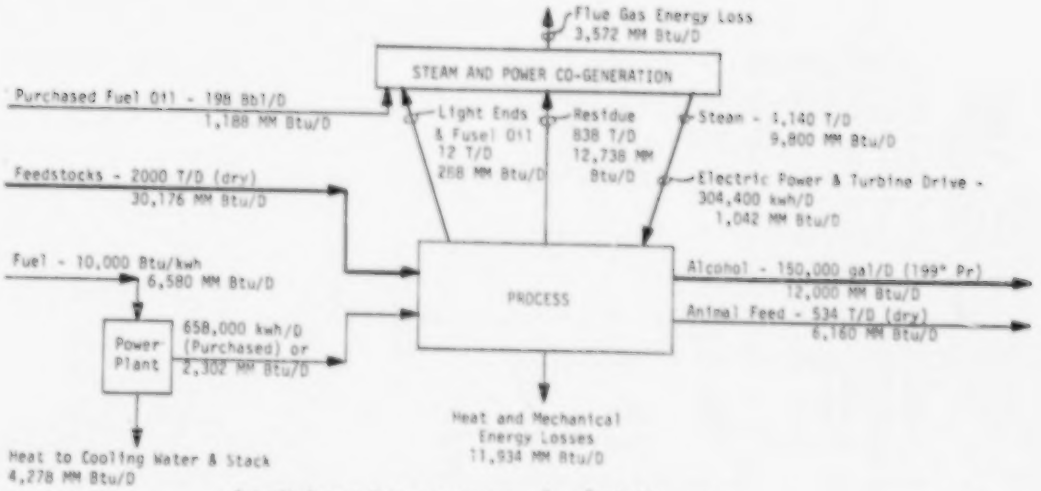
	10 YEAR AMORTIZATION WITH FEED BY-PRODUCT 100% COMPANY FINANCING	20 YEAR AMORTIZATION WITH FEED BY-PRODUCT 80% MUNICIPAL BOND FINANCING
	$/GAL	$/GAL
FIXED CHARGES	0.359	0.247
RAW MATERIALS, CHEMICALS	0.402	0.402
UTILITIES	0.212	0.212
LABOR	0.050	0.050
TOTAL PRODUCTION COST	1.023	0.910
BY-PRODUCT CREDIT	(0.420)	(0.420)
SALES, FREIGHT, G&AO	0.100	0.100
TOTAL OPERATING COST	0.702	0.590
INTEREST ON WORKING CAPITAL (10%)	0.000	0.020
INTEREST ON LOAN (6.5%)	0.000	0.110
PREVIOUS TAXABLE LOSSES PAID BACK	0.000	0.110
FEDERAL AND STATE TAXES (50%)	0.367	0.012
NET PROFIT AFTER TAXES	0.367	0.112
SELLING PRICE, 1983	1.436	0.954
SELLING PRICE PRESENT VALUE	1.096	0.728

TABLE 3
CELLULOSE, SYNTHETIC AND CORN ALCOHOL
OPERATING COSTS AND SELLING PRICES
OPERATING COST ESTIMATE FOR 1983
100% COMPANY FINANCING

PROCESS BASIS (MM USGPY)	CELLULOSE 25	CELLULOSE 50	SYNTHETIC 50	CORN 50
INVESTMENT TFI (1981), $MM	70.40	112.20	50.60	63.10
	$/GAL	$/GAL	$/GAL	$/GAL
FIXED CHARGES	0.451	0.359	0.165	0.203
RAW MATERIALS	0.402	0.402	0.774	1.201
UTILITIES	0.212	0.212	0.238	0.278
LABOR	0.100	0.050	0.018	0.046
TOTAL PRODUCTION COST	1.165	1.023	1.192	1.728
BY-PRODUCT CREDIT	(0.419)	(0.420)	0.000	(-.400)
SALES, FREIGHT, G&AO	0.100	0.100	0.100	0.100
TOTAL OPERATING COSTS	0.846	0.702	1.292	1.428
ADDITIONAL CHARGES				
FEDERAL AND STATE TAXES	0.456	0.367	0.174	0.228
NET PROFIT	0.456	0.367	0.174	0.228
ALCOHOL SELLING PRICE (15% ROI AFTER TAXES)	1.758	1.436	1.640	1.884
SELLING PRICE (PRESENT VALUE)	1.340	1.096	1.251	1.432

FIGURE 2

CELLULOSE ALCOHOL PROCESS - ENERGY BALANCE
DAILY BASIS: 2000 T/D DESIGN



Overall Gross* Energy Efficiency, $\left(\frac{\text{Products}}{\text{Feedstocks \& Power}}\right)$ = 48%

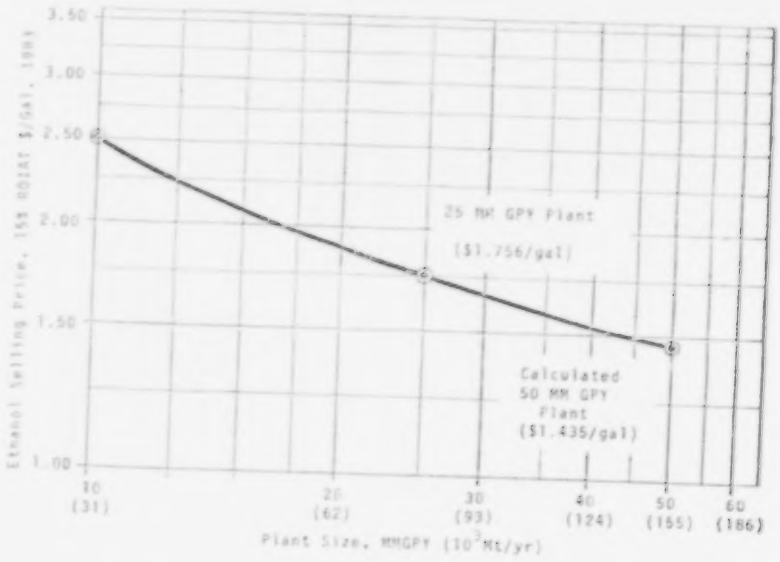
Overall Net Energy Efficiency, (Corrected for Boiler Efficiency Differences) = 51%

(*Neglecting Differences in Boiler Efficiencies among Various Fuels)

FIGURE 3

ETHANOL SELLING PRICE, 15% RDIAT

EFFECT OF PLANT SIZE

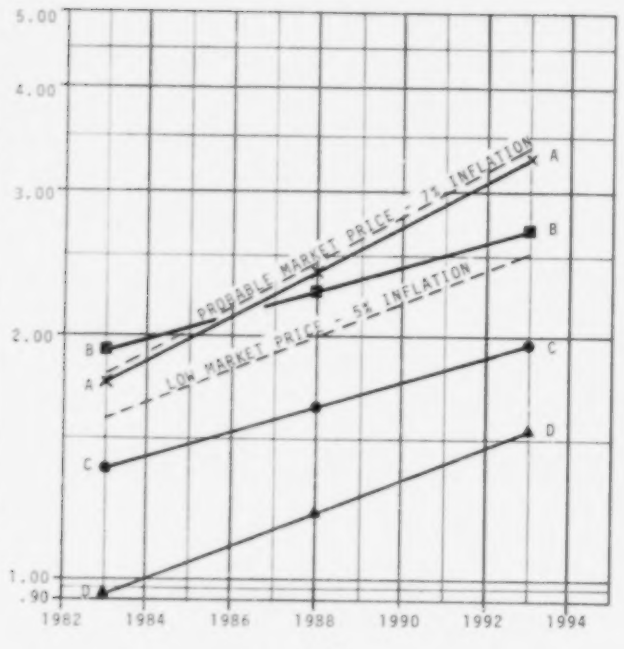


Investment (1981)

Capacity MMGPY	TPI $MM
10	39.7 - 42.0
25	70.4
50	109.2 - 114.6

FIGURE 4

COMPARATIVE ETHANOL ECONOMICS
SELLING PRICE FOR 15% ROIAT



Curve	Code	Process Raw Material	Plant Capacity	Fixed Investment	Method of Financing
A	×	Ethylene	50 MM GPY	$50.6 MM	100% Co.Financed
B	■	Corn	50 MM GPY	$63.1 MM	100% Co.Financed
C	●	Cellulose	50 MM GPY	$112.2 MM	100% Co.Financed
D	▲	Cellulose	50 MM GPY	$112.2 MM	80% Municipal Bond Financing

Mr. OTTINGER. Thank you very much, Dr. Frederickson.

We will hear next from Dr. John Radovich, University of Oklahoma.

[A biographical sketch of Dr. Radovich follows:]

RÉSUMÉ

JOHN M. RADOVICH Age 31

Education:

University of Notre Dame, B.S., Chemical Engineering, 1970, Maximum cum laude
Stanford University, M.S., Chemical Engineering, 1971
Washington University, D.Sc., Chemical Engineering, 1976

Experience:

6/71-9/73	Process Engineer, Sun Oil Company, Marcus Hook Refinery, Pennsylvania
9/75-6/76	Instructor, Chemical Engineering, Washington University
10/76-Present	Assistant Professor, School of Chemical Engineering and Materials Science, University of Oklahoma

Professional Organizations:

American Institute of Chemical Engineers
American Chemical Society
Tau Beta Pi
American Society for Engineering Education

Research Interests:

Membrane Separations of Colloids and Plasma Proteins; Mass Transfer of Macromolecules; Mass Transfer in Immobilized Enzymes or Whole Cell Reactor Systems; Conversion Of Biomass Into Energy.

Expertise in Fuels-From-Biomass Area

Publications and Presentations:

1. Radovich, J.M. et al, Evaluation of the Potential for Producing Liquid Fuels from Biomaterials, Electric Power Research Institute, EPRI AF-974, TPS 77-716, Palo Alto, California, January 1979.
2. Radovich, J.M. et al, "Conversion Processes for Liquid and Gaseous Fuels from Biomass", Section 13, EPRI/GRI Workshop on Biomass Resources and Conversion, EPRI WS78-79, July 1979.
3. Radovich, J.M., "Conversion Process for Liquid Fuels from Biomass", Proc. ISES International Congress, Atlanta, Georgia May 1979.
4. Radovich, J.M. "Technical Considerations of Biomass Conversion Processes" in Biomass Conversion Processes for Energy and Fuels, O. Zaborsky, S. Sofer (eds.) Plenum Press, New York, Spring 1980.

Publications and Presentations (Continued):

5. Radovich, J.M., "The Potential for Producing Liquid Fuels from Biomass", presented at Library of Congress, Congressional Research Service, Seminar on Energy From Biomass and Wastes, Washington, D.C., October 25, 1979.
6. Radovich, J.M., "Considerations of the Conversion Technology for Biomass As An Energy Source", to be presented at IEEE, COPS 1980 Conference, Oklahoma City, March 1980.
7. Radovich, J.M., "Liquid Fuels From Biomass" Invited to Present Paper for Seminar on Biofuels Synthesis, BioEnergy '80, Atlanta, Georgia, April 1980.
8. Radovich, J.M., "Liquid Fuels from Biomass: A Comparison of Existing and Developing Processes", A Statement Before the Committee on Science and Technology, Subcommittee on Energy Development and Applications, House of Representatives, February 22, 1980.

Consulting:

1978-Present	EPRI, on Evaluation and Planning for Biomass Energy
1/80-Present	SRE, Inc., on Anaerobic Digestion and Alcohol Fermentation (on-farm plants)

Courses Taught in Chemical Engineering:

Heat and Mass Transfer
Thermodynamics
Unit Operations Laboratory
Separations Processes
Introduction to Computer Programing

STATEMENT OF DR. JOHN RADOVICH

Dr. RADOVICH. Thank you very much, Mr. Chairman.

I want to give you a few facts concerning the other liquid fuels out there in the real world besides alcohol.

I don't think alcohol is the solution to our energy problems, but I do agree with Senator Bayh that it is the only solution we have right now, and in that respect it should be pursued.

There are many different liquid products which you can produce from biomass. Among them are pyrolitic oils, catalytic liquids, synthetic gasolines, and ethanol, from fermentation, which also can produce butanol.

I have tried to make a comparison of those processes with the fermentation process. Based on the critiera of liquid yield, product quality, liquid production energy benefit ratio, and thermal recovery in the product, those other processes, other liquid products are equal to or better than ethanol from fermentation.

In summary then of my opening comments, I think that a gasification process of biomass followed by liquid synthesis has greater potential but definitely is far less advanced in its development than ethanol fermentation.

In any kind of evaluation or comparison of processes, you have to set some guidelines. In this case it is very difficult to set guidelines or come up with consistent guidelines because of the lack of complete data for all of the processes; because of the different scales or stages of development of the different processes, and also because of the problems with comparing different energy products.

I compared the liquid yields, that is, the gallons of liquid produced per ton of biomass—this would be a dry ton of biomass. This data is presented in table 2 and table 3 of the written statement. If I use my base case process, ethanol from fermentation of wood, then if I look at methanol by gasification and liquid synthesis, I get a 70 to 140 percent higher yield of methanol. If I look at synthetic gasoline, the poly-gasoline, I either get a 16-percent lower liquid yield or 36 percent higher, depending on the range of data. The production of Fischer-Tropsch liquids, which are again through a gasification process, have about the same yield on a dry ton basis as ethanol. The production of pyrolytic oils which is a simple pyrolysis process, have anywhere from a 50-percent to a 16-percent less or lower yield than ethanol. Finally, the production of the catalytic liquefaction oils has a 60 or 70 percent higher yield than ethanol from fermentation of wood. If I use that same base and I look at the fermentation of cellulose, not wood, the process Dr. Frederickson was talking about, I have a 50 percent higher yield for fermentation of cellulose than I do for wood. For corn grain gives an 86 percent higher yield from fermentation than from wood. However, I want to emphasize that I am making a comparison based on fermentation of wood, using wood as the base feed stock because of the other processes. There is data available for wood but not available for corn grain.

I can then talk about the quality of the product produced. Any quality points that you give to an energy product depend upon the end use of the material, and a lot of the end use information or data to compare these energy products is not available.

As for a comparison of a synthetic gasoline, its performance in an automobile in comparison to ethanol's performance, I don't think there is sufficient reliable data to make a good comparison. But making the suggested analysis, and if I use my ethanol as the base case, methanol is probably of lower quality, because of its lower energy content and its increased toxicity.

The synthetic gasolines which can be produced by gasification, followed by liquid synthesis, are probably of much higher quality, because they are gasolines and they can substitute directly for gasoline.

The Fischer-Tropsch petroleum substitutes and their production or quality can be changed or adjusted according to the needs of the refinery. The pyrolytic and the liquefaction oils are definitely much lower quality. They are very corrosive. There is a lot of special handling of them and, again, their end use would probably not be the same as ethanol. They would just be used in furnaces.

I then move to a comparison of the amount of liquid energy coming out of a process divided by the energy that is used in that process. Again, you get on very thin ice when you make this kind of comparison, No. 1, because you are talking about an efficiency. Those calculations are subjective because it depends on what you define as your useful output and useful input. Since all numbers are not available for a lot of these processes, I only looked at the energy coming out in the liquid divided by the energy that went into the process to produce the liquid; not in the growing of the biomass or in the transportation, but just in the process to produce the liquid.

I used ethanol from fermentation as my base case, assuming it has a benefit ratio of 1. The absolute numbers and the comparative numbers are different as seen in table 5.

If ethanol is 1, methanol has a benefit ratio of 3, methanol from gasification of biomass followed by liquid synthesis. The production of gasoline by catalytically converting the methanol, according to the Mobil process, does not have enough information available to decide what the benefit ratio is.

Production of what we call polymerization gasoline gives you a benefit ratio of anywhere from 2 to 5. This is in comparison to an energy benefit ratio of one for ethanol. Fischer-Tropsch liquids, which is a process in which biomass is first gasified and converted to liquids, is being done at Arizona State University by Dr. Jim Keuster. It has a benefit of 6 compared to ethanol. Ethanol is 1. The information was not available to make a calculation for the catalytic liquefaction process.

There is the Department of Energy's project at Albany, Oregon, and small scale projects being developed throughout the country for pyrolytic or liquefaction oils. Pyrolytic oils produced by flash pyrolysis, the Occidental flash pyrolysis unit, have an energy benefit ratio of 1.7 to 4. This is compared again to ethanol at 1, ethanol by fermentation of wood.

I then proceeded to look at other different criteria for comparison (table 6). If I compare the energy in the liquid coming out and when I talk about energy, I mean the Btu content, to the energy or the higher heating value of the biomass feed which is, how much

energy you would get out of the biomass if you simply burned it under controlled conditions.

Again, I use ethanol as the base case of 1. Compared to ethanol, methanol will have a 50- to 80-percent higher thermal recovery. The production of Mobil gasoline from that methanol will have anywhere from 6- to 36-percent higher recovery. Production of polymerization gasoline has anywhere from a 10-percent lower thermal recovery to a 55 percent higher thermal recovery. In a lot of these cases I am giving you ranges of data, because of the different feedstocks that have been used under different conditions.

Fischer-Tropsch liquids, the synthetic hydrocarbons, will have anywhere from a 3 to 48 percent higher thermal recovery. The liquefaction oils from catalysts are 36 percent higher, and the pyrolytic oils have a 33 percent higher recovery. Based on those criteria: yield, quality, energy benefit ratio, and thermal recovery, the nonfermentation products and processes show up better in most cases, particularly the gasification followed by liquid synthesis.

However, I must re-emphasize——

Mr. OTTINGER. Could you repeat that last sentence?

Dr. RADOVICH. I said based on the criteria that I have discussed, yield, quality, energy benefit ratio and thermal recovery, the nonfermentation processes show up equal or better than fermentation. There is room for argument about how accurate the percents are in each of these calculations.

Based on what Senator Bayh said earlier, none of those processes are producing liquid fuels which could be used for transportation today. I think the reason for that, in my mind, is that it is directly proportional to the amount of effort on funding dedicated to each of those areas.

All but the ethanol fermentation processes are at the laboratory scale. I have indicated the project scale in the figure. Lab scale is that which the production or feed rate of biomass is less than one dry ton a day.

I might add that ethanol fermentations are commercially available. However, I might also point out that they are commercially available only for grains, not for cellulose materials, nor for wood. The project at the University of Arkansas, developed by Gulf Science and Technology that Dr. Frederickson talked about, is probably the most fully developed, nongrain fermentation process that is available today. It is at the pilot plant stage and they are planning to go to a commercial development stage.

I would like to sum up these comments by saying that I believe that there are other things out there besides alcohol fuels, but they are certainly not there today.

Thank you very much.

[Dr. Radovich's prepared statement follows:]

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LIQUID FUELS FROM BIOMASS: A COMPARISON OF EXISTING AND DEVELOPING PROCESSES

John M. Radovich
Assistant Professor
School of Chemical Engineering and Materials Science
University of Oklahoma

A report presented to
U.S. House of Representatives
Science and Technology Committee
Subcommittee on Energy Development & Applications
February 22, 1980

SUMMARY

The purpose of this report is to compare existing and developing processes for converting biomass to liquid fuels. The processes and subsequent liquid products which were analyzed are:

1. pyrolysis to produce pyrolytic oil
2. liquefaction to produce liquefaction oil
3. gasification then liquid synthesis to produce methanol, poly gasoline, Fischer-Tropsch liquids, or synthetic gasoline
4. fermentation to produce ethanol

The criteria used in this evaluation included:

1. liquid product yields
2. liquid product quality
3. liquid energy benefit ratio
4. thermal recovery in the liquid product

The results of this analysis indicate that gasification followed by liquid synthesis is superior in many of the categories. However, its current state of development does not approach that of fermentation for certain biomass feedstocks. Its potential contribution to the future liquid fuels' supply cannot be ignored.

The results in this report must be used with caution because of the incompleteness of material and energy balance data for some processes; the variation in the scale or state of development of the different processes; and the use of different biomass feedstocks in the processes.

INTRODUCTION

Biomass represents a renewable resource that can be converted into liquid fuels. The purpose of this report is to compare the existing and developing processes for converting biomass into liquid fuels.

Biomass is any terrestial organic matter, such as trees, plants, agricultural crops and grasses which can be grown specifically as a feedstock for an energy producing process. This definition includes forestry and agricultural residues, but excludes human and animal wastes, i.e. municipal solid waste, sewage sludge, manure, water crops, aquaculture and moriculture are also excluded. Processes for converting biomass feedstocks into liquid fuels must cope with their many undesirable processing characteristics: high moisture content, difficult solids handling, diffuse (low density) and seasonal availability.

There are two fundamental methods of converting biomass to liquid fuels: thermochemical conversion and biochemical conversion. Thermochemical conversion involves the addition or release of heat during chemical conversion to products. Biochemical conversion involves the use of biological organisms to change the biomass into products. High moisture biomass (>50% by weight) is a more suitable feedstock for biochemical conversion; thermochemical conversion would require a net input of energy. The conversion processes to be considered for liquid fuels are given in Table 1.

TABLE 1

Conversion Processes for Liquid Fuels from Biomass

- Thermochemical
  - pyrolysis
  - liquefaction
  - gasification-liquid synthesis
- Biochemical
  - anaerobic digestion
  - fermentation

Conversion Processes

Pyrolysis is the thermal decomposition of organic materials by indirect heat transfer in the absence of oxygen, without the addition of steam, hydrogen, or carbon monoxide to the reactor. Pyrolysis produces varying amounts of liquids, gases, and char depending on the feedstock and operating conditions. Liquid product yields are maximized by rapid heating rates (short residence times) to moderate temperatures and immediately quenching of the gases and condensible vapors.

Liquefaction involves the direct hydrogenation of biomass at high temperatures and very high pressures. Hydrogen and a catalyst to promote the reaction must be added.

Liquid fuels can be obtained by converting synthesis gas, a mixture of carbon monoxide and hydrogen, to methanol, Fischer-Tropsch liquids and poly gasoline. In gasification, the relative amounts of CO, CO_2, H_2, CH_4 and light hydrocarbon gases produced

can be varied by changing the amount of air, oxygen or steam added to the biomass. Methanol synthesis is a high pressure catalytic process requiring a 2 to 1 ratio of H_2 to CO in the feed, with only small amounts of CO_2 (<0.2%) and about 1.1% inerts (N_2 etc.) permitted. The methanol can be converted to gasoline via the Mobil process using a zeolite catalyst. Fischer-Tropsch liquid synthesis uses a different catalyst and requires a H_2 to CO ratio of 1.7-2.8 and only permits low inerts (<1.1%). The quality (boiling range) of the liquid hydrocarbon product can be varied by changing the H_2/CO ratio, catalyst and operating conditions. An alternate source of gas for Fischer-Tropsch Synthesis is pyrolysis gas. Production of gasoline by polymerization, poly gasoline, is accomplished by converting the olefins from a gasification reactor into liquid hydrocarbons which boil in the gasoline range.

Methane generation by anaerobic digestion is accomplished by series and parallel reactions which are catalyzed by certain bacteria and which decompose the organic material. Since the conversion of methane, (natural gas) into liquid fuels requires reforming to a mixture of CO and H_2 (steam reforming) and then liquid synthesis, the conversion efficiency of the entire biomass-to-liquids process will be significantly less than conversion processes which directly gasify the biomass. Thus, anaerobic digestion as a source of liquid fuels will not be considered further.

Ethanol can be produced from cellulosic material by a combination of hydrolysis and fermentation. The hydrolysis step which produces fermentable sugars, can be accomplished by acid

treatment or enzymatic reaction. Note that many forms of biomass must also be pretreated to make the cellulose susceptible to hydrolysis.

PROCESS EVALUATION

Liquid Yields

The amount of liquid product obtained from biomass is given in Table 2. Yields, expressed as gallons per oven dried ton (ODT) of biomass, were calculated from data reported in the references. In some cases the yields were extrapolated from laboratory data. Operational details, as well as material and energy balances for many of these processes can be found in the works of Radovich et al.(1), SRI (4) and Mitre (6) reports. If we assume that the yield of ethanol from fermentation as our base (1 gal/ton) then a valid comparison of yields can be developed as shown in Table 3. With the exception of flash pyrolysis and production of gasoline via methanol, all thermochemical processes have equal or higher liquid yields than fermentation. This comparison is desirable when we wish to choose between competing conversion processes for the same biomass feedstock. Note that it would be meaningless to compare the liquid yields from corn and wood for any process!

Liquid Product Quality

An evaluation of the quality of liquids from biomass conversion processes depends on the end use of the liquid. To make such a comparison, performance data for each product in the desired

TABLE 2

LIQUID YIELDS FROM BIOMASS

BIOMASS	PROCESS	PRODUCT	YIELD gal/ODT	REFERENCE
wood	flash pyrolysis	'oil'	25-42	1
wood	catalytic liquefaction	'oil'	78-85	2,3
wood	gas-synthesis	methanol	86-120	4,5,6
MSW,bark	gas-synthesis	polygasoline	41-68	7
wood	gas-synthesis	F-T liquids	50	8
wood	gas-synthesis	gasoline	30-40	9
wood	fermentation	ethanol	50	5,10
MSW+ Millwastes	fermentation	ethanol	75	11
corn grain	fermentation	ethanol	92.9	12,13
corn stover	fermentation	ethanol	23-62	14,15,16
wheat straw	fermentation	ethanol	23.2	16
sugar cane	fermentation	ethanol	54.5	16,17
sweet sorghum	fermentation	ethanol	59.6	18

TABLE 3

LIQUID YIELDS FROM BIOMASS FOR NONFERMENTATION PROCESSES

BIOMASS	PROCESS	PRODUCT	YIELD (wood)
wood	flash pyrolysis	'oil'	.5-.84
wood	catalytic liquefaction	'oil'	1.56-1.7
wood	gas-synthesis	methanol	1.72-2.4
MSW,bark	gas-synthesis	polygasoline	.84-1.36
wood	gas-synthesis	F-T liquids	1
wood	gas-synthesis	Mobil gasoline	.6-.8
wood	fermentation	ethanol	1
cellulose	fermentation	ethanol	1-1.5
corn grain	fermentation	ethanol	1.86

application must be available. Reliable data of that sort is lacking. However, a few general comments can be made. The pyrolytic and catalytic liquefaction oils are more viscous, are very corrosive and contain less energy than fuel oils. They are also unsuitable for further processing to refined products. Such characteristics would require special equipment and handling if they were used in industrial burners. The Fischer-Tropsch liquids are essentially substitute hydrocarbon distillates which can be treated and refined in much the same manner as petroleum distillates. Their substitution quality is excellent. The poly gasoline and "Mobil" gasoline are essentially equivalent to their petroleum-derived counterparts. The alcohol fuels, methanol and ethanol, are good fuel substitutes. Ethanol is superior to methanol because of its higher energy content and lower toxicity. There is insufficient data to make a valid comparison of gasoline blends of these alcohols.

In summary, the Fischer-Tropsch liquids and synthetic gasolines are of the highest quality followed by ethanol, methanol, the liquefaction and pyrolytic oils. The relative energy contents are given in Table 4.

At this point, some measure of the efficiency of the conversion process must be determined. The general energy efficiency of a process is defined as Ne = (net useful output)/(valuable input). The net useful output is defined as the desired energy produced by the conversion process. The valuable input is the energy that is required, the "energy that costs", to produce the useful energy output. The determination of "useful output" and "valuable input"

TABLE 4

Energy Content of Liquid Fuels: BTU/gal.

Pyrolytic Oil	97,000-113,000
Catalytic Liquefaction Oil	132,000-150,000
#2 Furnace Oil	130,000-150,000
Fischer-Tropsch Liquids	124,000
Gasoline (biomass and petroleum derived)	135,000
Ethanol	85,000
Methanol	65,000

will depend on the process. These choices are arbitrary, thus the confusion when comparing efficiencies. When all the choices are consistent among a group of conversion processes producing liquid fuels, the comparison of energy efficiencies is probably meaningful. However, all the data required for calculating Ne is not available for some of the overall processes under consideration. (See ref. 1 for efficiencies of some individual processes.) In most cases, there is data available to make some first estimates of the liquid energy benefit ratio and the thermal recovery in the liquid product.

Liquid Energy Benefit Ratio

The Liquid Energy Benefit Ratio (LEBR) is defined as:

$$\text{LEBR} = \frac{\text{energy content of liquid product output}}{\text{energy consumed in conversion process}}$$

This energy is expressed in terms of the higher heating value (HHV) of the liquid. Note that in many cases, the energy consumed during conversion is of high quality (e.g. electric power, fuel gas). These energies are put on a equivalent BTU basis which considers the conversion efficiency of producing the energy, e.g. 33% conversion efficiency for fossil fuel to electricity, 75% for fossil fuel to electricity. LEBR indicates the gain in high quality liquid energy by the process. The LEBR for the liquid products from a wood feed under consideration are in Table 5. A normalized LEBR is also tabulated, assuming that ethanol production has a LEBR of 0.5. Note that all the other liquid products have a higher LEBR compared to ethanol. Data was not available for calculating LEBR for the catalytic lique-

TABLE 5

LIQUID ENERGY BENEFIT RATIO FOR BIOMASS-DERIVED LIQUIDS

Liquid Product*	LEBR	LEBR/LEBR of Ethanol
Pyrolytic Oil	3.4-8.2	1.7-4.1
Liquefaction Oil	not available	—
Methanol	1.5	3.
Polygasoline	1.-2.5	2-5
Fischer Tropsch Liquids	3.0	6.
Mobil Gasoline	not available	—
Ethanol	.325-.70	1
Ethanol (corn)+	.54-.64	—

* Produced from a wood feedstock

+ see references

faction oils nor the Mobil gasoline. The LEBR for the liquefaction oils is definitely much less than the value for the pyrolytic oils because of the severity of the operating conditions. The LEBR for the Mobil Gasoline is smaller than that of methanol because methanol is an intermediate product in the process.

Thermal Recovery in Liquid Product

The thermal recovery in the liquid product is defined as:

$$TR = \frac{\text{energy content of liquid product}}{\text{energy content of dry biomass feedstock}}$$

The energy contents (in BTU) are the higher heating values. TR indicates the fractional recovery of the energy of the biomass feed. The values of TR for the products from a wood feedstock for each process under consideration are given in table 6. They were calculated by the formula:

$$TR = \text{Liquid Yield } \frac{gal}{ODT} \times \frac{BTU/gal}{BTU/ODT} \times 100$$

The ratio of the % Thermal Recovery of a given product versus that of ethanol (33) are also tabulated. Note that the other liquid products provide higher thermal recoveries than ethanol production. These values can be put in perspective when comparing them to the efficiency of stream generation in wood-fired boilers which ranges from 60% to 80%.

Conclusions

In all the categories considered, liquid fuels derived from non-fermentation conversion processes were equal to or better than ethanol. These biomass-derived liquids can potentially make a greater contribution to the liquid fuel supply than ethanol.

TABLE 6

PRODUCT THERMAL RECOVER IN THE LIQUID PRODUCT

Liquid Product*	% TR	TR/TR for Ethanol+
Pyrolytic Oil	44	1.33
Catalytic Oil	58	1.76
Methanol	50-60	1.52-1.82
Polygasoline	31-51	.91-1.55
Fischer-Tropsch Liquids	34-49	1.03-1.48
Mobil Gasoline	35-45	1.06-1.36
Ethanol	25-40	1
Ethanol (corn)	49	—

* wood feedstock

+ assumed to be 33

However, the state of development of these biomass processes lags far behind that of the fermentation process, as summarized in Figure 1. With the exception of gasification itself, the non-fermentation conversion processes are at the laboratory or bench scale stage (processing rates less than 1 dry ton of biomass per day). there are no processes which take a biomass-derived synthesis gas and convert it into methanol, although the methanol synthesis technology is commercially available. The Mobil gasoline process using methanol as feed is in the laboratory stage of development. Note also that fermentation processes are commercially available for grains but are at the polot plant stage for wood. The stage of development is probably directly proportional to the level of effort and funding (regardless of the source). Without adequate support in the future, non-fermentation processes will lag far behind in development. Their potential as indicated by the aforementioned comparisons is too great to ignore.

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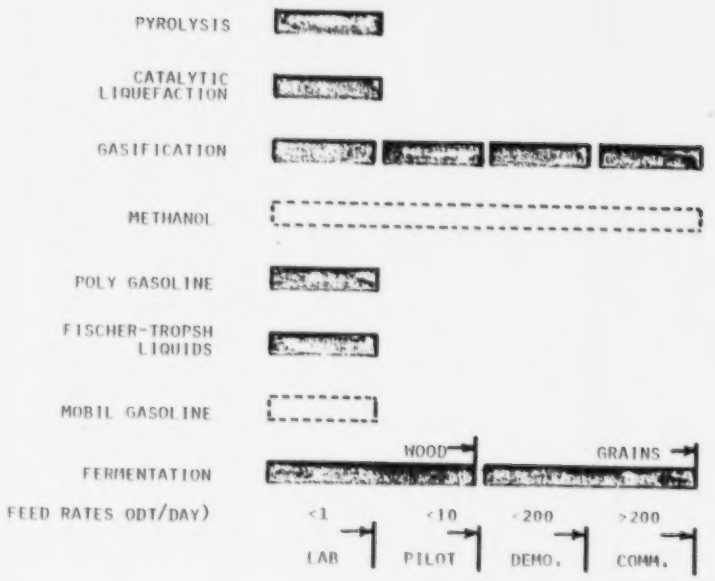
STATE OF DEVELOPMENT WINTER 1979-80



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Mr. OTTINGER. Thank you.

We will hear now from Mr. Ladd M. Seaberg, general manager and vice president, Midwest Solvents, Inc., Atchison, Kans.

[A biographical sketch of Mr. Seaberg follows:]

March 4, 1980

LADD M. SEABERG

BIOGRAPHICAL INFORMATION

Personal Data:

Born - June 14, 1946; Beaumont, Texas
Married - Karen Cray Seaberg
Children - Lori Lynn, Melissa Anne
Parents - Mr. & Mrs. Ivan Seaberg; China, Texas
Military Service - U.S. Army Reserve (1969-1970)

Education:

China Grade School - China Texas 1952-1960.
Forest Park High School (Cum Laude) -- Beaumont, Texas 1964.
Texas Tech University (B.S. Chemical Engineering) Third in graduating Class of 1969.

Professional Positions Held:

Summer of 1967 -- Midwest Solvents -- plant operator
Summer of 1968 -- Research Assistant -- Texas Tech.
1969-1970 Production Manager of Distillery, Midwest Solvents Co.,Inc.
1970-1972 Vice President & Manager of the Starch Div.,Midwest Solvents
1972-1979 Vice President & Plant Manufacturing Mgr., Midwest Solvents
1979-to date Vice President & General Manager, Midwest Solvents Co.,Inc.

Board of Directors Positions Held:

Midwest Solvents Company, Inc., Atchison, Kansas
McCormick Distilling Company, Weston, Missouri
Atchison Leather Products Co., Inc., Atchison, Kansas
Exchange National Bank, Atchison, Kansas

Licenses & Affiliations:

1. America Institute of Chemical Engineers
2. Water Pollution Control Federation
3. Wheat Gluten Industry Council
4. Waste Treatment Plant Operators License Class IV
5. Federal Communications Commission First Class Radiotelephone License
6. Technical Committee - Distilled Spirits Council of U.S.

STATEMENT OF LADD M. SEABERG

Mr. SEABERG. Thank you.

Midwest Solvents Co. has been manufacturing alcohol since 1941 in Atchison, Kans. We are a grain distillery and have primarily produced alcohol for the beverage industry since the end of World War II. Since July of 1979 we have been producing 10,000 gallons per day of 200 degree proof fuel grade ethyl alcohol.

Our process for making alcohol is proven through many years of experience. We have continually improved our plant process through new ideas and techniques. For example, 10 years ago our process required 170,000 Btu's process energy to produce 1 gallon of ethyl alcohol.

Today, our process energy has been reduced to 105,000 Btu's required per gallon. If we were producing all fuel grade alcohol, this energy requirement would be approximately 90,000 Btu's per gallon.

I would like to add that the issue of quoting energy balances is a very confusing one. It depends very much on what part of the system you are balancing, and in many cases you may only hear quoted a portion of the energy required for the process.

We are limited by physical space to carry out any further expansion at our Atchison, Kans. location. For a number of years we have thought of a second location for a plant. Last year we received one of the USDA loan guarantees for biomass conversion. The plant was to be located in the Rio Grande Valley of Texas in a joint operation with a sugar mill.

The plan had many innovative process possibilities with energy usage possible from the sugar mill. There also was innovation in the raw materials proposed such as sweet sorghum and vegetable wastes. The project was withdrawn when legal difficulties occured in obtaining a permit.

Recently, Midwest Solvents has purchased the American Distilling plant in Pekin, Ill. The sale is subject only to the pro forma approval of the stockholders of American Distilling. This is one of the few dormant plants in the country with real potential to support President Carter's objective of accelerating domestic production of alcohol fuels.

We expect to start the American plant up this summer and ship 190 degree proof fuel grade alcohol to Atchison for further processing to 200 percent proof alcohol.

Before we make substantially large investments into the gasohol market, we would like some assurance that it is here to stay. Without the present 40-cent-per-gallon Federal subsidy we would not be selling fuel grade alcohol in Atchison today.

There is just too much spread between gasoline prices and alcohol prices for the gasohol blender to buy alcohol and not require some form of subsidy. We need some assurance that this market is real and won't disappear in 5 years.

We have received criticism in the past for our presentations at hearings such as today on our information on energy balances. We still believe this is an important part of a Government program for fuel independence and conservation.

Government aid should go into plants that are energy efficient and use fuels other than oil. This program should emphasize coal,

biomass, waste heat, cogeneration and other energy modes that show energy efficiency.

A gasohol plant today running on oil will be a net consumer of foreign oil and will hurt our position on importing oil.

When Midwest Solvents first thought of purchasing the whiskey distillery at Pekin, Ill., we anticipated using industrial revenue bonds for financing. This could have perhaps saved us 30 percent over conventional financing. However, industrial revenue bonds are restricted to a total investment ceiling of $10 million for a 3-year period.

If more than $10 million were used for the project from any means of financing then we would forfeit the bond financing. When President Carter's interest was shown to promote an expanded alcohol fuels program then our strategy certainly was to not get tied to industrial revenue bonds and restrict rapid expansion possibilities.

If additional financing can be obtained at a reasonable rate, Midwest Solvents is prepared to install a new low energy level innovative distillation system which would more than double the present size of the whiskey distillery to 20 million gallons per year by the end of 1981.

Midwest Solvents needs Government assistance in providing the additional funding necessary for expansion. To date, we have been somewhat frustrated because nothing has come out of Washington to give us a direction in securing the financing necessary to meet President Carter's goals.

With our expertise and experience, if we get the necessary financial backing, we can have 20 million gallons per year of additional alcohol fuels in production by the end of 1981.

The issue today is directed toward whether we support the establishment of an Office of Alcohol Fuels, and I would say if that office means that something concrete will come out in the area of funding to really get production in gear, then we are for that proposal.

Mr. OTTINGER. Thank you very much.

Let me recognize my colleagues for questions in the order of their appearance.

I believe Mr. Hance is first.

Mr. HANCE. Mr. Seaberg, in your testimony you mention on page 2, I believe, talking about the energy balance that the gasohol plant today running on oil will be a net consumer of foreign oil and will hurt our position on importing oil. In all of the operations you all have been involved in, what has been the net energy loss or gain?

Do you look at that at each individual project? Do you have any figures on that?

Mr. SEABERG. Well, it depends on the individual project. In other words, at the Texas location, for which we had the loan guarantee approval, it showed a very positive gain, because we were fueling the plant with biomass from the sugar cane process.

In the Atchison, Kans., plant when we are on No. 6 fuel oil, periodically we are restricted at that location from using natural gas, we show very much of a loss of energy.

As I mentioned in my presentation, we are improving that all of the time. If you take the total fuel entering the process versus the Btu content of the alcohol coming out of the process, it still is a loss.

Mr. HANCE. The bottom yield of the Texas plant was because you all were seeking to get some type of ruling that you could turn it into a distillery in case gasohol didn't work out?

Mr. SEABERG. It turned out to be a lot more than that. There are many laws in Texas. That was one of the problems that you are addressing there.

Since the program is a subsidized program and that is one issue I addressed today, we worried that 4 or 5 or 10 years down the pike that the program might be similar to the program during World War II, when the Government had a program for producing industrial alcohol.

As soon as the war was over and the program ended, there were over 100 alcohol plants closed down at the end of that program, and we didn't want to get caught in that spot after investing a rather substantial amount of capital and no place to go in the market, so that was one of the reasons.

There are other laws that restricted us. We sell beverage alcohol through a subsidiary in the State of Texas, and they have laws that restrict you from having two permits at the same time.

Dr. FREDERICKSON. May I comment, Mr. Chairman?

Mr. OTTINGER. Yes.

Dr. FREDERICKSON. The real shortage today is in liquid fuels. We have a relative abundance of coal.

According to the Department of Agriculture approximately 95,000 Btu's of liquid fuels is required to produce a bushel of corn. This includes fuel for farm operations, transport, and the production of fertilizers and pesticides. One bushel of corn produces about 2.5 gallons of alcohol and one-third of a bushel of Distiller's Dried Grains. As a rough approximation, therefore, about two-thirds of the agricultural Btu's or 66,000 Btu's, represents the liquid fuel chargeable to alcohol production. The heating value of 2.5 gallons of alcohol is roughly 200,000 Btu's. Thus the Btu in the alcohol is approximately three times the Btu as liquid fuel consumed in agricultural operations.

The above analysis is valid only if coal or biomass are used to generate the steam and electric power required for the alcohol plant operations. If fuel oil is used to generate the steam and power, alcohol production contributes very little toward the alleviation of the liquid fuel shortage.

Mr. OTTINGER. Would the gentleman yield?

Mr. HANCE. Yes.

Mr. OTTINGER. This is another important factor, and that is that you are not producing Btu's. What you are talking about is liquid fuels to run automobiles. The Btu or the heat value of the thing is not all that we ought to concentrate on. The higher octane makes a real difference.

In order to achieve that higher octane with gasoline, they have to refine it. As I understand it, there is about a 6 percent energy penalty involved in that, so you are displacing not just the 10

percent you are adding in alcohol but the 6 percent lost in refining. That changes the energy balance very considerably.

Without objection, I would like to enter into the record a paper that addresses that problem by Mr. Pincas Jawetz, who is here with us this morning.

[The information follows:]

testimony on the subject of gasohol by

PINCAS JAWETZ

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tel: (212) 535-2734

for the record of the hearings on the Review of proposed Fiscal Year 1981 budget for programs of the U.S. Department of Agriculture within the jurisdiction of the Committee on Energy and Natural Resources, United States Senate.

Washington D.C. February 6, 1980

Mr. Chairman and members of the committee:

Gasohol is the most reasonable answer to the need for high-octane unleaded gasoline created by the phased elimination of lead compounds and by the requirement for high octane fuel for the newer cars.

When one replaces 10% gasoline by ethanol one increases the octane value of the resulting mixture by 3 points. As a result one does not replace therefore merely gasoline but rather the octane boosting component (e.g. benzene, toluene, MTBE) that is produced at the refinery in a more energy intensive fuel reforming process, and in effect by using ethanol one backs out at least twice as much crude as one would assume by a mere 10% gasoline displacement (additional information relating to this point is attached, see: Pincas Jawetz, The Economic Realities of Alcohol Fuels, The Sugar Journal, January 1980).

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U.S.D.A. in the 1978-1979 crop year has taken out of production 18.7 million acres of good farm land via set-aside and paid land diversion programs. This land alone could have produced 4.8 billion gallons of ethanol which would have backed out about 10 billion gallons of crude or 230-250 million barrels of oil or about 0.68 million barrels of oil/day (This calculation is based on the conservative value of 254 gallons of ethanol per acre or about 10% lower than last year's national average of over 109 bushels of corn per acre). Now if additional distillery feedstocks will be pulled into production and a distillery takes only 1-2 years to build, one can see that it is possible without great difficulties to produce by this method about 1 million barrels of oil equivalent per day.

As an example of the economics of such an operation let us take the case of the 2.8 million acres of diverted corn land which brought in 20 cents per bushel of corn for the eighty percent of the land planted by the particular farm, or $160 per "diverted" acre. With this money, had the farmer produced corn on this acre, the 254 gallons of ethanol could have been entitled instead to 0.63 cents "ethanol production" subsidy without additional expense to the taxpayer. This alone would have made gasohol economically competitive.

U.S.D.A. does not have a set-aside program for F.Y. 1981 and in its calculations for grain supply and demand it reserves 150 million bushels of corn to satisfy the requirements created by the D.O.E. goal to produce 500 million gallons of ethanol. This translates to a requirement of about 1.5 million acres of corn land and the worry exists that U.S.D.A. may yet decide on a land diversion program to take additional millions of cropland out of production. How about formulating a policy that would use the funds that are needed in a diversion program to create instead funds to subsidize the construction of new distillery capacity? Such an active policy on the part of U.S.D.A. could double or triple the capacity envisioned by D.O.E. and again this would not cost the taxpayer anymore than the agricultural programs would have spent anyway.

Presented at
The First InterAmerican Conference on Renewable Sources of Energy
New Orleans, November 1979

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THE ECONOMIC REALITIES OF ALCOHOL FUELS

by Pincas Jawetz
Independent Consultant

Fermentation alcohol has been obtained from many crops and gasoline-ethanol motor fuel mixtures are being used in various countries.

When regarding the ethanol not just as a mere extender of gasoline, but rather as an octane boosting additive for the production of high octane unleaded gasoline, one obtains a set of very favorable economics. In effect each gallon of ethanol displaces over 2.5 gallons of crude, removes the need for expensive reforming equipment, a huge new market is opened for agricultural commodities, and a whole new network of relations can be established in our hemisphere.

The phasing in of fermentation alcohols as an energy source provides us with an opportunity for establishing a holistic view on National policy via the coordination of farm policy, energy policy, fiscal policy, foreign policy etc. this as a substitute to the present single area, emergency stop-gap approach to policy.

Fermentation Ethanol has been obtained from sugar crops, starch crops and from lignocellulosic residues. These materials contain carbohydrates with a chemical composition of glucose or hexuloses or more complex molecules which are multiples of these individual six carbon sugar units. Yeast can ferment simple sugars but when the feedstock is a more complicated starch or cellulose containing material, the carbohydrate polymer has first to be broken down to simple sugars by means of heat, enzymes or acids. When using starches this chemical process is quite simple, for the case of cellulosic feedstocks further studies are needed in order to develop an economical industrial system for the production of ethanol.

The manufacture of ethanol from biomass provides a renewable source for energy, a way for an improvement in the balance of payment and for decreased political dependence upon foreign sources of energy, a possible diffusion of this dependence on foreign sources of energy, as well as a new market for indigenous agricultural commodities.

What is even more interesting from a policy point of view, the production of fermentation ethanol allows for the establishing of a holistic approach to National policy with farm policy, energy policy, foreign policy, fiscal policy, labor policy etc. gathered and redirected towards a unifying goal. Such an approach would be a welcome change from the stop-gap emergency acts as symbolized by separate measures taken under the name of farm policy or energy policy.

The Use of Fermentation Ethanol as an Octane Booster for Unleaded Gasoline:

Misinformed parties have managed to shroud with erroneous arguments the debate for using ethanol as an extender to the supply of gasoline. As

an example I will quote here a Letter to the Editor of the Washington Post, titled "Why the Gasahol Concept Evaporates" and signed Joe E. Penick, President, Mobil Research and Development Corporation. In summary Mr. Penick's arguments are: (a) the price of grain alcohol is three times the price of gasoline at wholesale, (b) it takes twice as much energy (in the form of diesel fuel, gasoline, fertilizers, fuel oil etc.) to grow the corn and operate the distillery than is contained in the final product, (c) as a result from (b) the more gasohol we use the more foreign oil we import, (d) as a result from (c) the outpouring of dollars will increase and not decrease.

Having mentioned this now let us study the facts, and let us see how the use of gasohol could in effect be of a large help to the oil industry as well as to other sectors of our economy.

When blending ethanol with low octane unleaded gasoline one finds that up to a certain composition roughly three percent ethanol enhance the road and motor octane average value of the mixture by one octane point. A 10% ethanol - 90% gasoline mixture - the so defined gasohol - enhances by over three points the octane value of the low octane unleaded gasoline we started with. In effect we need to enhance just by three points the octane value of regular unleaded gasoline in order to adjust the fuel to the requirements of 1978 and newer car models, that is under conditions, we are not allowed to use tetra ethyl lead or manganese compounds in order to achieve the higher octane values. Considering this it becomes clear that ethanol is not just an extender of gasoline but it replaces rather octane boosting additive reformates such as benzene or toluene, branched chain compounds or other additives the like of methyl tertiary buthyl ether (MTBE).

According to the American Petroleum Institute, six percent more crude is consumed when one produces at the refinery high octane unleaded gasoline, than if low octane gasoline would have been the final product. This means that when achieving 10 gallons of the high octane gasoline value by mixing 1 gallon of ethanol with 9 gallons of the low octane product, one uses one gallon of ethanol in order to displace 1.6 gallons of a petroleum product. Also, in the process of doing so one has removed the need to build new expensive catalytic refiners.

From experience one knows that high octane unleaded gasoline at the pump costs somewhere from 3 cents to 8 cents more per gallon. As such, for this reason alone, one can say that this differential shall entitle a gallon of ethanol a premium of 40-80 cents per gallon, and when one considers that a gallon of fermentation ethanol could cost as little as $1.00 - $1.20 per gallon the three facts mentioned up to now,

(a) a factor of 1.6 in gasoline displacement value,
(b) the saving in capital investment by the oil company, and
(c) the premium price allowed to ethanol,

should be enough to prove to the refiner that it is his self interest to help phase in ethanol as an octane booster.

Alas, the abovementioned arguments are only a first step towards a rational analysis of the place of fermentation-fuel-ethanol in our economy.

The factor 1.6 obtained above has to be multiplied by two additional factors that we will develop now in order to calculate a conversion value that will show us how many Btu of gasoline does one replace by using one Btu of ethanol. After obtaining this value for the *use* of ethanol we will look into the *production* of ethanol and the multiplication of the two values thus obtained will give us the energy balance that shows how much useful energy output does one obtain from one Btu input in the production of ethanol.

The Btu/gallon value for ethanol is about two thirds that of gasoline: 84.861 vs. 127.654 Btu/gallon. If one uses the alcohol for a boiler fuel one will find that one has to use a larger volume of alcohol to substitute for fuel oil. When using pure alcohol in a motor vehicle engine one finds that the volume of alcohol needed is only slightly larger than the volume of gasoline it replaces - that is ethanol shows an efficiency as a motor vehicle fuel much higher than one would assume from its Btu value alone. Furthermore, when using ethanol-gasoline blends one finds in effect that a smaller quantity of the mixture is needed to replace the pure gasoline fuel. The gain in motor vehicle fuel efficiency can be attributed to the octane value enhancing capacity displayed by alcohols.

The two additional factors needed in order to calculate the conversion value that will show us how many Btu of gasoline does in effect replace one Btu of ethanol, are based on the measurement of miles per gallon achieved when using in an actual fleet test gasohol which is then compared with the average miles per gallon obtained when using pure gasoline.

The first factor is derived when assuming for a moment that one obtains with gasohol an equal usefulness in terms of miles per gallon as with gasoline. The actual efficiency of a Btu of ethanol is thus increased by 50% and a factor 1.5 results.

The second factor is derived from fleet test observations that show that in effect an increase in miles per gallon is obtained when using the mixture. As no reliable results are yet at hand from such sources as the U.S. Department of Energy, one can therefore not argue with results proposed following fleet tests in the States of Nebraska, Illinois and Iowa. Taking an average of these values, 5.7 percent, one obtains the factor 1.57.

When multiplying the three factors 1.6 x 1.5 x 1.57 = 3.77 - the use of each Btu of ethanol replaces 3.77 Btu of gasoline, and remembering that a gallon of ethanol has only the 2/3 value in Btu of a gallon of gasoline, one obtains therefore that each gallon of ethanol replaces 2.5 gallons of gasoline.

In order to calculate the effective energy balance one has to multiply this value with the energy balance in the *manufacture* of the ethanol. Using the A.P.I. suggested value of 0.5 our argument is that even under those conditions, when taken as a worst case analysis limit 0.5 x 3.77 = 1.88, and the energy ratio is positive. Furthermore, as new distilling processes are established and energy credits for the other products such as the D.D.G. are included, Professor Melvin Calvin has calculated the ethanol output to energy input ratio 1.76 rather than 0.5. Applying the new value to 3.77 shows a net 6.6 Btu useful energy produced per each Btu of energy input when manufacturing fermentation ethanol. The input includes all the energy needed to produce the fertilizers, for agricultural machinery, for the distillation equipment etc.

Fermentation Ethanol as a new Outlet for Agricultural Commodities:

In order to support the price of grains and of cotton in the 1978-1979 agricultural year 18.7 million acres

have been taken out of production with a total cost of over $1.6 billion. Also large reserves of grains are being kept in storage: similarly the Commodities Credit Corporation is holding on to large quantities of sugar. These policies may have had historically their good reasons but today it is unforgivable that this country was not able to link its tremendous potential to overproduce in the agricultural sector with the need for liquid fuels that can be answered by opening up a new market for this potential to increase agricultural production. If one had grown corn on the 18.7 million acres mentioned above there would have been available across the board 32 cents for a subsidy per gallon of ethanol produced by using up just a total expenditure equal to the funds spent in order to keep this land out of production.

As the argument goes - it is unethical to use food in order to make fuel. But how can we accept such an argument when in effect we support policies to depress our agricultural production. Rather, the existence of unproducing lands does nothing for food supplies. Only planted and harvested - the land reserve becomes a food reserve. Only if grown and harvested - do we have a food reserve that we could use as food in the case of an emergency. A gasohol program will allow this practicality.

U.S.D.A. contends that next year there are not going to be set-aside or land diversion programs as the U.S.D.A. *hopes* that the Soviet Union is going to buy our surplus grain. In effect the lands that have been returned to production, the abovementioned 18.7 million acres that could have produced 4.8 billion gallons of ethanol could still be producing protein rich Distillers' Dried Grains for export while allowing us to retain the ethanol produced from the carbohydrate part of these grains. The Agricultural Act of 1978 could even provide the legal background for implementing such a policy.

The Potential for Louisiana in a Fermentation Ethanol Option:

The State of Louisiana seems to be destined to become the location for future major alcohol distilleries.

Louisiana being a sugar cane grower and also being the location of some of the largest grain elevators and transit for about 40% of the nation's export of grain, promises to have no shortage of feedstock for alcohol distilleries.

The local oil refineries and the network of oil pipelines could provide an outlet for the ethanol that could be blended here with gasoline and shipped north already as ready mixed high octane unleaded gasoline.

Furthermore, the new superport will allow for increased imports of oil to supply the refineries when the time comes that there is a shortage of U.S. production of crude. Also, the same superport can be a destination for sugar cane or even for ethanol shipped here from the Caribbean area, from Central America or from more distant Latin American ports. The Louisiana legislation provides tax incentives for locally distilled alcohols without requiring that 90% of the feedstocks has to be of local production. In effect one should welcome such a legislation when addressing energy policy issues. Our foreign policy difficulties do not stem from the dependence on energy imports as such, but rather from the very localized source of these imports from the Persian Gulf Area. A further diffusion of our energy sources and a relation with Western hemisphere friendly nations, could relieve some of our political worries. On the other hand, an increase in imports of sugar to the United States could help stabilize western hemisphere economies, and this as such is another goal of U.S. foreign policy.

We do hope that this First Interamerican Conference on Energy from Renewable Sources will be remembered as a marker pointing towards new relations in our hemisphere.

Conclusion:

There is no excuse for the slow pace in which the fermentation fuel ethanol is being developed in the United States and there is every hope that when new energy policies will be implemented this renewable resource will take its right place as an alternate fuel. Countries all over the globe will follow the example of Brazil and other Latin American and Central American countries that have recognized a long time ago the potential of using surplus sugar crops in order to produce fuel ethanol. The United States will hopefully start a new era of cooperation with her neighbors to the south providing them with aid to develop non-nuclear sources of energy of mutual interest.

Mr. OTTINGER. I wondered if you took that into account, or are you merely concerned with what goes into the plant and what comes out of the plant?

Mr. SEABERG. My figures reflect merely the amount of fuel applied to the plant versus what you get out of the plant.

Mr. PATTERSON. There is one other issue here that has come up and needs to be addressed. I think the issue of the amount of energy it takes to grow the corn or grain is basically a bogus issue. I have stated in my testimony that the alcohol production process actually enables us to improve the efficiency of agriculture. In view of the fact that this issue has arisen again in Mr. Frederickson's testimony, I believe that I should make clear the details on this issue. When we feed kernel corn to livestock, half of the nutrition in that corn passes through the animal and out into the manure pile. In contrast, when we enzymatically treat the grain in the process of making alcohol, we improve the digestability of the corn so that the nutrition in that corn is more readibly available to the animal than it was in the initial kernel grain. All the minerals, vitamins, and proteins remain; all that has been removed is the carbohydrate content. Apart from the absence of the carbohydrate which is readily replaceable from other carbohydrate sources, we have a superior livestock feed. In addition, we have yeast products in the mash that have additional high protein and high vitamin B value of their own. Therefore, the nutritional content of the corn has actually been improved in addition to having been made more readily available to the digestional processes of the animal. Dairymen, for example, note a 30-percent increase in milk production when feeding distillery mash. These findings mitigate against including the cost of growing corn in the energy cost of alcohol production. I think it is time that this issue should be put to rest once and for all.

Mr. OTTINGER. I thank the gentleman from Texas for yielding.

Mr. HANCE. One other question of Mr. Patterson.

Have you or any of the members of your group worked at setting up a small gasohol still that could be marketed for any such production in Georgia?

Mr. PATTERSON. I am from Virginia. I am not from Georgia.

Mr. HANCE. The book you passed out indicates you are from Georgia.

Mr. PATTERSON. That is right; that booklet was prepared by the American Agriculture Movement office in Georgia, and I brought it along because I feel that it is an illuminating pamphlet. As you are aware, the American Agriculture Movement is a national movement which is made up of State organizations within the national movement. Sometimes other States have valuable materials which we share. That is the spirit in which I offered you the Georgia pamphlet this morning. In response to your question about the manufacturing of small alcohol stills that can be marketed, there are now numerous farm scale projects underway, so many that it is impossible to go into each of them in detail here. However, it is definitely clear that the experience gained in the construction and operation of these plants is advancing us toward the capability of being able to design and market a turnkey operation which can be sold for the use on many farms nationwide.

Mr. HANCE. Are there any that are profitable right now? If a farmer went out and purchased one and purchased corn, are there any profitable ones?

Mr. PATTERSON. I think I could say yes to that, but at the present time it is not a question of offering a turnkey operation that anyone I know of who is reliable is capable of bringing to your farm on a pallet with a manual of operation instructions. There are such plants, I understand, but I do not believe that the best systems have been set up for that type of delivery yet. I believe the best systems at present have been built on site and and are still being developed and refined technically by the farmers themselves. There are more and more farmers who are getting enough experience and information together to make a plant manufacture feasible, but we are not yet at a point where I feel there are reliable energy efficient systems deliverable on a pallet. Let me also say in relation to a comment made on the question of net energy balance by Mr. Seaberg that the net energy figures that I submitted related to the heat involved in processing the grain from the start of the enzymatic treatment through fermentation and distillation. No cost of mash drying is included, as the mash in this case is simply squeezed and fed in a moist state.

Mr. OTTINGER. In order to meet our 11 o'clock deadline, I am going to have to limit questioning to 5 minutes each.

Mr. GORE?

Mr. Gore. Thank you, Mr. Chairman.

In response to the last question that was addressed, I am told that there are three companies that are competing with each other to bring out a turnkey unit by this spring in the $25,000 to $30,000 range, and that by April they hope to be marketing such units.

Farmers Home Administration, Mr. Chairman, I am told, is considering a plan to affix a seal of approval on one or more of these units, if they meet certain safety standards and conversion ratio standards, and there has been up until now an absence of those turnkey units for the on-farm operation and the home-made versions may have some difficulty in getting the proof up to a high enough level.

It is pretty easy to build a still.

Mr. PATTERSON. Exactly; I would like to stress that as a caution you want to be very careful, both in the homemade version and the turnkey operations, the production of alcohol is not difficult. As for the distillation of alcohol, moonshiners have been doing it for years in my county and State, but their techniques and knowledge is, by and large, not applicable to the issue of making fuel alcohol.

Mr. GORE. For gasoline anyway.

Mr. PATTERSON. Either way, from 170 proof right on through. We are capable on the farm of drying the alcohol totally to an anhydrous product, but the point is that we want to watch the net energy balances, and if those plants are not efficient from the standpoint of energy in and energy out, then they should be discarded and not given further consideration.

Mr. GORE. I don't like this net energy balance analysis. I think that it is a red herring. It has been discussed already. I did want to say one other thing, the key question is the proof. If you are going to have gasohol, and what the problem has been with the home-

made units, it has been getting it up to a high enough proof to mix well with the gasoline, and there are plans in the works that have turnkey units in the $25,000 range.

Now, I think in examining the net energy balance, it is important to examine the byproduct credits, not only the use of the mash as a livestock feed but also the use of the manure for methane gas to power distillation units.

If you can work this into a farm system it improves the economics. I wanted to add one word of caution for the record on the feeding of mash.

The use of mash as a pure feed may not be the best approach. It will work, but you may not get the gain on your animals that you need. It needs to be mixed with feed; and, Mr. Chairman, I would like to mention at this point the results of a study conducted by the Tennessee Valley Authority on this question.

They got two groups of animals. Those were beef cattle, and the first group was fed a set amount of hay and 100 bushels of corn; the second group was fed the same quantity of hay and only 80 bushels of corn. The other 20 bushels of corn were run through a distillation unit, and the mash was mixed in with the 80 bushels.

Now, group A, that was fed the 100 bushels of corn, gained an average of 474 pounds over the cycle.

Group B gained an average of 535 pounds over the cycle, so the benefits of the mash are very real but, at the same time, other farmers who have fed 100 percent mash have experienced a reduction in the weight gain, so it has to be done carefully, and I wish USDA had some research going on in this area and maybe we will hear from their witnesses on this question.

On this question of net energy balance, I think this is the most ridiculous red herring that has served as a brick wall in this field. People have run into it and said, oh, there is not a net energy balance. The problem with it is it is a re-analysis and if you apply the same analysis to other energy resources you come up with similar results.

Look at the field of nuclear energy, and add up all of the energy consumed in mining, processing, diffusing, enriching, and building the reactors, and compare that to the amount of electricity that comes to an individual's home; well, the net energy balance is not there.

If you take a hydroelectric dam, the amount of energy being pressed down on the generators is far, far greater than the amount of energy that finally gets to somebody's home; but most people would prefer to have a color television set in their living room than a waterfall running through their living room, so the question is usability.

What form is the energy in; that is the key question.

As Dr. Frederickson said, the key shortage is in liquid fuels and that is what we need to concentrate on.

Mr. Seaberg, are you familiar with the new developments on the part of National Distillers, the makers of Almandine and Old Grandad? They have applied for six patents on a process using recombinant DNA, and they have created a new organism to cut the cost of the fermentation process.

Has that caused much discussion in your industry?

Mr. SEABERG. Nothing has come out yet that is really to the point of talking about as a process. There is much work that has been done in a laboratory, and it is very exciting and in time maybe it will become a process.

Mr. GORE. The reason I bring this up is I had a workshop this past Saturday on gasohol. We expected 750 people, and 4,000 showed up. The enthusiasm on energy and interest are all there, and as we went through the process step by step all day long, the experts from around the country who came had to insert footnotes all through their presentations.

Every step of the way they would say, now wait a minute, this person out in California or Kansas or Georgia has a new process that is going to change this step. We are seeing exciting developments along every single step of the way, and this recombinant DNA is one of the most dramatic.

It is pending the resolution of the issue in the Supreme Court on whether new life forms can be patented.

Mr. SEABERG. Those are proposed processes. They may or may not work. Time will tell. They are very exciting, and this is how you do make breakthroughs.

Mr. GORE. Some are proposed; some are reality. Tell us something about the new developments in extrusion.

Mr. SEABERG. I have read some articles on extrusion. I frankly don't believe the results of how they talk about certain gains in yields. They don't make any sense in my opinion.

Mr. OTTINGER. I hate to cut the gentleman off but I am going to have to in fairness to my other colleagues.

Mr. GORE. Thank you, Mr. Chairman.

Mr. OTTINGER. I would hope that the witnesses would be available to answer any written questions that the panel might want to ask afterward.

Mr. Ertel?

Mr. ERTEL. Thank you, Mr. Chairman. I only have a couple of questions.

Many of the programs that the Government has set up specifically for the farmer in relationship to developing stills have been grants by the DOE which pass through the Department of Agriculture, and they then go to the farmer to try and utilize.

Have you any experience with those, and how do they work?

Mr. PATTERSON. Are you suggesting that there have been Federal funds set aside through DOE passed through the USDA that have gone to grassroot farmers to make alcohol?

Mr. ERTEL. I was under that impression.

Mr. PATTERSON. I am glad to have you bring such an issue up.

There was some money appropriated by the Congress for this purpose, and the Department of Agriculture did not see fit to give this money to farmers. They thought that was not a profitable place to put it. They were at that time very concerned about what distillery mash would do to the soybean meal market, and that was part of their reasoning in denying farmers the opportunity to participate in the program money made available. Instead they made all that money available to large-scale plants.

I believe Midwest Solvents was one of the grant recipients, and I think they later turned back the money; is that correct?

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Mr. SEABERG. It was nothing but a loan guarantee. The application was withdrawn.

Mr. PATTERSON. I see. All right. Well, in any case, I am not aware of any farmers that you could call grassroots farmers that received even loan guarantees at that time.

There was a DOE program last year, small-scale technology and wholesale information that was sent out making small money available in the maybe $3,000 to $5,000 range. I heard of nobody who received any money, but I heard about a lot of people who applied for it. Of course, it was not just for farmers.

You are in competition with people who have skilled backgrounds in this area and, by and large, the money goes to those who make it a business, consulting firms, et cetera, who make it a business to get money to do this kind of exploratory work very often, and farmers lose eligibility, even though they have the capability and good ideas.

Mr. ERTEL. Do you have any recommendations on how we or the Congress could in fact insure that farmers have the ability to receive whatever funding would be appropriate to develop technology at the grassroots levels?

Mr. PATTERSON. I think I can fairly speak for the people in our movement. When I say that we are frustrated with the idea of having to wait for Federal grants in order to proceed with the development of alcohol fuel on the farm. We feel that the ideas are feasible and that the technologies are proven. We can build plants right now even without subsidy if we had the money. We need profit in agriculture so that we can form the capital to build the plants, and in the absence of immediate profit, we need some way to borrow so that we can afford to get started, but ultimately it is not possible for us to borrow our way out of debt. In some fashion, somehow, we have to return profitability to agriculture so that farming with or without alcohol production as part of it can be a profitable paying operation for those involved. An alcohol program over the longer term ought to be able to pay its own way, and very widely among our farmers the idea of waiting for a grant application that you might hear about a year later is of little interest. We want to do something now; we are in trouble now as a Nation and as farmers, and we need something to get agriculture back on its feet. We don't want to wait until next year after we have submitted a long application and waited long months to see if they've decided to fund our application or give the money to somebody else. So we really look at the grant operation process as a way of retarding the whole alcohol fuel effort rather than advancing it.

Mr. ERTEL. Are you suggesting then something like a loan guarantee or a loan program?

Mr. PATTERSON. A loan program certainly, as I said; something along the lines of that half a billion dollars that went into the nuclear industry back in the 1950's every year for 10 years running might makes sense. Brazil has made that kind of commitment to its alcohol fuel industry. There is no logic in a loan guarantee if you can't get a loan, and my banker tells me that there is no money available in my bank for any purpose, so before we can begin, credit has to be injected into the system in some fashion.

Mr. ERTEL. I would suggest there would be money available if the interest rate were high enough; I am sure they would be happy to loan it to you.

Mr. PATTERSON. We are all aware that the large operators that have the leverage in the market in order to pass their interest costs on to the ultimate consumer can get money.

The problem is in rural America where we don't have that kind of market leverage, and we have to pay those interest costs off the top and the interest rates in the range that they are now are not conducive to the kinds of capital development that we need to get a competitive system going in this country to rebuild the economic system that our forefathers envisioned.

Mr. ERTEL. Now, what you are saying is quite frankly any program we set up which was to reach the grassroots farmer has been nonexistent or has been nonworking.

Mr. PATTERSON. I think that is pretty much correct, yes, as far as alcohol energy development goes, yes.

Mr. ERTEL. Thank you very much.

Mr. OTTINGER. Mr. Blanchard is not here.

Mr. Glickman is not here.

Mr. Royer?

Mr. ROYER. Thank you, Mr. Chairman.

I think Dr. Radovich gave us some comparisons as a base of the benefit ratio system. Is there any merit to develop the same kind of chart in comparison to gasoline itself?

Dr. RADOVICH. Somewhere around 4, 5 or 6, somewhere in that range.

Mr. ROYER. Would you explain that to me?

Dr. RADOVICH. If I take the energy that comes out in the gasoline divided by the energy that comes into or that is used to process or produce that gasoline in the refinery, that liquid energy benefit ratio is somewhere around 5 or 6, whereas, ethanol production, it is less than 1 in the plant now.

Mr. ROYER. OK; I am trying to get to the point where everybody has indicated, the liquid fuel is the real shortage and what are the best alternatives in your fields to provide a substitute for that, taking into consideration the red herring that the gentleman from Tennessee raised, and so on.

What are the technologies and so on? Is it not possible with all of the things we are able to do? We want somehow to come up with which ones are most competitive and which ones could be marketable if we got busy and got going.

Dr. RADOVICH. You have thrown quite a few conflicting criteria at me there. No. 1, the only thing that is available now that could be marketed is ethanol.

No. 2, things that are 5, 10, 15 years away that show the most promise are gasification followed by the liquid synthesis, the Fisher-Tropsch liquids, the methanol and the synthetic gasolines. They show the most promise compared to ethanol.

Mr. ROYER. For the substitute for the liquid fuel shortage that you are talking about?

Dr. RADOVICH. Right.

Mr. ROYER. The other point you made about what the nonfermentation process for the future shows, well, not for now, but certainly they have capability in other areas, do they not?

Dr. RADOVICH. I don't understand your question.

Mr. ROYER. Well, are they available today as other alternatives for liquid fuel but in other capacities that might free up other sources?

Dr. RADOVICH. OK; well, the gasification processes, what they are normally available for now, is to produce a low Btu gas or medium Btu gas which could be used in industrial burners.

Mr. ROYER. That is what I am trying to get at.

Dr. RADOVICH. That gas that is produced can be used as a feed stock to produce a liquid, OK. But right now, the only, say, commercially or near commercially available uses are to burn it as an industrial fuel.

Mr. ROYER. Mr. Frederickson, maybe you would be the best one to respond to this.

What do you generally think of the DOE program as it stands as far as R. & D. is concerned? Do you have any general thoughts or recommendations or suggestions?

Dr. FREDERICKSON. Well, frankly, we have done some work for the DOE and it was done under what we consider favorable circumstances, and that was a substantial study on alcohol production. Other than that, I don't think I have had enough contact with the programs and the financial sponsorship to make any kind of a judgment.

But I will take the opportunity to respond to this question of getting Government funding. The problem in Federal procurement, it seems to me, is the assumption that everybody is crooked. This results in what I consider to be overzealous concern with accountability which makes proposal writing very expensive and time consuming.

I would like to see the Government back off somewhat on accountability, recognizing that an occasional crook might slip through. I believe the net result would be favorable to the Government.

Mr. ROYER. How about in the area of funding for hydrolysis?

Dr. FREDERICKSON. We have not been involved in any of those programs but we have a general familiarity.

Dr. Katzen, the president of our company, was responsible in large measure for the design of a wood hydrolysis plant in Springfield, Oregon, at the time of World War II and starting up that plant in its early years, and at that time it was uneconomical.

He tends to be generally cold on that subject.

Mr. ROYER. The $30 million has been denied?

Dr. FREDERICKSON. I am not aware that it has been denied. I was simply setting forth our estimate of what that program will entail. I am not aware that it has ever come to a decision yet.

Mr. ROYER. I guess there was a supplemental request on OMB that was denied.

Mr. OTTINGER. For the Alcohol Fuels Office.

Mr. ROYER. I am wondering about your thoughts pertaining to the use of that, if it was made available.

Dr. FREDERICKSON. The use of the $30 million would go immediately into the construction of the demonstration plant if it were available, and we are ready to go immediately with the procurement of the equipment.

Mr. ROYER. The benefits of being able to do that in your opinion would be substantial?

Dr. FREDERICKSON. Yes, sir.

Mr. ROYER. Thank you, Mr. Chairman.

Mr. OTTINGER. Mr. Young?

Mr. YOUNG. Thank you, Mr. Chairman.

For Mr. Seaberg, why would you be shipping from the distilling plant that you apparently have taken over back to Kansas? There is a difference of 190 proof to 200? What does that mean?

Mr. SEABERG. The Pekin plant basically is a whiskey distillery. It will require modifications, changes in the process, before it will be a fuel-grade alcohol plant. We will be able to start that plant up quicker by making 190-proof alcohol this summer. We do have some excess anhydrous capacity at our Atchison, Kans., plant, and that way we can get it started while we are putting in the equipment at Pekin.

Mr. YOUNG. Is there anything readily available in the Illinois, Kentucky, Tennessee area—where it might be more convenient and less costly to ship it back to Kansas? Or has your company looked at that possibility?

Is any further encouragement needed in your industry?

Mr. SEABERG. The shipping to Kansas will only be for a short period, and it depends on the financing that becomes available as to how rapidly we will expand the Pekin plant. There is a lot of potential.

Mr. YOUNG. You are looking strictly at the Federal Government. Have you looked at any other private industry that might be somewhat related to what you are trying to do and that may be closer?

Mr. SEABERG. We have looked at all types of financing, and the interest rates are very high; and the reason we are looking at Government financing is because it is generally thought in the form of a grant or guarantee it would be a less costly financing.

Mr. YOUNG. But that does not cut out the possibility of a joint venture with any other private corporation.

Mr. SEABERG. No; it all depends on how quickly you want to move, how much risk you want to take. All of those factors have to be taken into account.

Mr. OTTINGER. Mr. Wolpe?

Mr. WOLPE. The Presidential target recently announced was for a 500-million-gallon level. I would like to get the reaction of the participants to that particular projected target. Is it about right, too low or too high?

Mr. PATTERSON. With whom do you want to start?

Mr. WOLPE. Whoever would like to lead off.

Mr. PATTERSON. In terms of current production capacity, it is too high. Our feeling is that the only way that you can get anything close to that kind of production capacity on line to meet those targets is by building lots of small-scale plants. Although we can build plants that are too small, given present technology, there is

definitely an optimum efficiency of scale that applies in this industry with all factors considered. Major factors that have to be considered are the cost of transportation of the feed stock resource, the drying of the byproduct, and the hauling of the byproduct back to the animals.

Very often, those elements have not been considered, and it is because of such considerations that we feel confident in the statement that on-farm and small community plants can be the most efficient in alcohol production, although there are some byproduct possibilities which can change these equations somewhat. There is no question but that there are some farmers who are moving down a blind alley developing plants primarily for providing alcohol for their own use that will be too small in terms of their labor costs—if they figure their labor costs and farmers are particularly well-known for not counting their own labor time. Ultimately, as a matter of national policy, we should seek to make sure that plant sizes make sense. I believe that 20 gallons per hour on a full-time continuous basis is probably a sensible minimum for an efficient plant size, given the fact that we have not yet been able to fully automate the systems. That is not a very large-scale plant, but it is larger than some that have been discussed and developed.

If we can get to the point where a farmer can start the process and then go away to do other work and have the system shut itself off when distillation is completed, then we will be able to reduce the size of the operation even further. Even then, however, we want to make sure that all costs are covered and the full economics are documented as they would be in any other business. At present, we are making fairly rough estimates based on the experience we have had so far.

Mr. WOLPE. What would be the capital requirements for distillers?

Mr. PATTERSON. It could be in the $200,000 to $250,000 range, for a turnkey operation, I would expect, but if you are going to put in substantial effort at constructing your own plant, using shared experience—working together—you can reduce that substantially.

We have costs for the still alone, for example, at 20 gallons per hour up to the 40-gallon-per-hour range for just the distillation unit of as low as $3,000 to $4,000 using scrap materials.

That does not include the tanks, and you have to make some judgments about how big you want your fermentation and enzymatic treatment to be, et cetera.

If you were operating in the neighborhood of a 25,000-gallon tank capacity, including a building and a distillation system, a conservative figure from the standpoint of not getting in without enough capital, and having to find additional capital before starting production, I would plan on $200,000 to $250,000 for a turnkey system.

Mr. WOLPE. Would the other panel members like to respond?

Dr. FREDERICKSON. I don't recall when the deadline was for the $500 million.

Mr. WOLPE. It was 1981.

Dr. FREDERICKSON. We regard the largest single train plant, at about 50 million gallons per year?

You go into multiple trains and you don't begin to save as much when you simply begin to make the machinery bigger. I am not

aware of what the fabrication capabilities of the Nation are for 10 such plants, but I would say it would be extremely difficult to have those in place by the end of 1981.

Mr. WOLPE. What would be the capital requirement for one?

Dr. FREDERICKSON. Our estimate in 1978 dollars, or I think current dollars is something like $63 million for a 50-million-gallon plant.

Mr. SEABERG. It is still the figure of $2 million per million gallons of annual capacity. As it gets bigger, it gets more efficient. In today's dollars, it is maybe $75 million.

Dr. FREDERICKSON. The DOE figures came out at $58 million. It's a very substantial investment; and, of course, as you go down the 10-million-gallon plant, for example, would be close to $30 million today.

I might say that I can't back this up, but there have been rumors that there are a lot of "snake oil" salesmen selling farmers plants with rather questionable designs.

Mr. PATTERSON. That's right.

Dr. FREDERICKSON. We are currently making a study for the Government on the economics of small-scale plants, and that is due for publication around the first of May, so at that time we at least will have a much better feel for what the economics are of small-scale plants for on-farm utilization.

Mr. SEABERG. In our case, especially at the Pekin, Ill., location, we can move very rapidly because much of the equipment is already in place. We already have the engineering and the technological expertise to move rapidly.

In the area of procuring of equipment, as many plants go ahead and make feasibility studies, get their financing and start to purchase equipment, there is going to be a tremendous shortage and a long delay in procuring equipment.

Many suppliers are already talking as far as 18 months just to get materials to the plantsite, so this is going to push back the plant time when plants will be able to come on line at full capacity. I would like to add, there is much fraud in the marketplace in the area of equipment design and sales.

Mr. PATTERSON. May I add one more comment on this issue?

Mr. OTTINGER. Very fast.

Mr. PATTERSON. Methane technology provides us with another loop that we can effectively include to optimize the entire alcohol-agriculture-food production system. In Gettysburg, Pa., the Mason-Dixon Dairy Farm uses the manure from 700 cows to produce enough electricity to meet two-thirds of the farm's electric needs.

The farm has been paying $30,000 a year for electricity. Of that, $20,000 worth of electricity is being generated by the methane facility. The plant cost about $60,000 to build, using mostly farm labor. If it had been built on a turnkey basis, the cost would have probably reached $150,000. It would be quite compatible to add alcohol production to the total operation. Together with a dairy or feedlot operation, the two systems can integrate very well. At present, the minimum efficient size for this type of methane facility is estimated to be around 300 to 400 cows, whereas the alcohol plant size I have outlined needs to have about 3 times that number of animals available close by in order for the mash to be fed in wet

form before it goes sour. The two systems are compatible because it is easy to sell and transport mash to nearby farms. With these kinds of plants installed, America's farms net can become exporters of electricity as well as exporters of liquid fuel.

Mr. OTTINGER. Unfortunately, our time has run out. My apologies to my colleagues who arrived late.

It is very imporant we do hear from the Department of Energy and the Department of Agriculture.

I would like each of you to supply us for the record what you feel your views are, what kind of commitment and where it ought to be made, in fiscal year 1981.

Agree on the areas where you can, where demonstrations of existing technology may be worthwhile, technology developed through the pilot stage and for which it would be worthwhile, and give us some dollar figures on that, because we are going to have to deal with that question immediately.

The sooner you can supply us with that the better.

I want to thank you all very much.

Mr. VOLKMER. If the witnesses would agree, I would like to submit questions to the witnesses and I will do it in writing.

Mr. OTTINGER. I have asked that the witnesses respond to any questions.

I want to thank you very much for your help.

We will hear next from the Department of Energy and the Department of Agriculture.

The Department of Energy is represented by Dr. Bennett Miller.

I also understand that Mr. Steve Potts is in the audience. Since he is temporarily assigned to head the Alcohol Fuels Office, we would appreciate it if he would join us as well.

We have Mr. James Williams, the Deputy Secretary from the Department of Agriculture.

I will try to keep the hearing moving. Mr. Gore has gone over to vote. He will come back and relieve me.

There is a potential outrage at the inability of the Department of Agriculture and the Department of Energy to get together. I have a sense of gratification that the administration has announced a goal of producing 500 million gallons of fuel by 1981. We are terribly concerned with the small number of people in the program, the small number of dollars devoted to realizing this goal, and lack of a research base to bring on the technologies that could make a significant contribution.

I would like to point out, in Brazil they are presently producing alcohol at the rate of 750 million gallons a year. They plan to go to 2.2 billion gallons a year by 1985. Their resources, in terms of land and technology, certainly are not superior to our own; probably considerably less than our own. It seems to me what is lacking here is a lack of resolve and determination to mobilize the country in doing some of the things that are ready now.

I would hope that the efforts of the Government would really focus on moving with the kind of resolve we saw in Brazil to make this contribution to our own problem within the near future.

We are very pleased to have you with us Mr. Williams. We will hear from you first, then the Department of Energy.

We would like to hear what the capability of your program is to meet the President's goal of 500 million gallons of alcohol production. We also would like to have you address what the outstanding problems are in reaching an understanding with the Department of Energy and when we can hope to have that problem resolved.

We are pleased to have you here with us, and we are looking forward to hearing from you.

STATEMENT OF JAMES WILLIAMS, DEPUTY SECRETARY, U.S. DEPARTMENT OF AGRICULTURE

Mr. WILLIAMS. I will make a sort of an opening comment. I will not go to the prepared remarks; the committee has that information. And we will be glad to take any questions from you, written or otherwise.

I would like to spend a couple of minutes reviewing what the circumstances are and how we have developed into a positive position on alcohol fuels in this past year.

Last year I came here in January. At that point in time, imported oil was running in the range of $13.80 a barrel. We did an economic analysis and showed with a strong subsidy that alcohol fuels could in fact be produced. This year, the new pricing is more like $28, and doubled during that period of time. The current subsidy of 40 cents a gallon has made it a very positive situation. We would expect for that to continue and ior that profit level to increase.

USDA has allocated in its 1980 budget $100 million in the Farmers Home Administration, B. & I. program for alcohol fuels. Another $10 million is allocated for on-farm loans for small scale plants in Farmers Home. We also have $6 million for research at the Peoria laboratory, and the Tifton research center—for a total of $116 million available both in research, direct lending, and loan guarantees in the 1980 year. We would continue those in the 1981 level.

In addition to that, as late as last night, I had a meeting with Deputy Secretary John Sawhill at the Department of Energy in which we discussed a number of alternative ways to try to deal with the problem of how DOE would be involved in the alcohol fuels program. In essence, we do not yet have a firm administration position on the issue. But clearly, the conference committee report that has already been passed, at least agreed to in conference, includes a 40-cent subsidy and 30 cents for anyhdrous per gallon for alcohol. This will give the needed incentives, both as to loan guarantees and direct lending on performance operating statements, possible.

We have not gone yet to a signoff with DOE on a passthrough in 1980. Some $11 million is set aside to USDA for the 1981 budget year.

I am not sure when we will be able to complete that. We have asked the Science Education Administration, the Forest Service, and the Economic Statistics Cooperative Services, ESCS, who would be handling those passthrough dollars and management of projects, to sign off on agreements with DOE before we actually take over the management of those contracts. To this date we still have not been able to get that resolved. We discussed it last night with Mr.

Sawhill, and he has promised me he would go back and any way he can help speed up that process. We are available to assist. But as of today we cannot ask our agencies to be responsible for management of contracts we have not yet identified in terms of scope, purpose, and time until we know what is in them. I believe Mr. Sawhill agrees we need to complete that quickly.

The other point I would like to make for the committee is the position of USDA as far as the alcohol fuels program is concerned.

In management of our agricultural programs we have taken into consideration the demand for corn for alcohol fuels in the short term. Until some date in the future when cellulosic conversion becomes feasible, corn will be an important feedstock for alcohol fuel. Because of the cost of fuel feedstock supply would impact on other uses, we recognize alcohol fuel, the same as we do the production and export of food and fiber. So when we make production or marketing decisions in USDA, fuel alcohol feedstock will simply be recognized as one other legitimate demand against the policy for USDA to formulate on food and fiber.

With that I think I will simply stop and respond to whatever questions you have.

[The prepared statement of Jim Williams follows:]

Statement by Jim Williams
Deputy Secretary of Agriculture

before the

Committee on Science and Technology
Subcommittee on Energy Development and Applications
Honorable Richard Ottinger, Chairman
House of Representatives

February 22, 1980

Mr. Chairman and Members of the Committee, it is a pleasure to appear before you today to discuss the alcohol fuels program of the Department of Agriculture.

Although my presentation today centers on alcohol fuels production from agricultural products, it needs to be set in the overall context of the USDA biomass energy program. This is necessary because much of our research effort is directed toward enhancing the growth of biomass crops--crops which are utilized directly in the production of alcohol fuels, but also can and are being used to produce other forms of energy. Therefore, our alcohol fuels program is not a specific entity, but rather an important component of the total biomass and synthetic fuels production effort within USDA.

Both the President and Congress have emphasized the use of ethanol in near-term national energy policy. We at USDA are fully committed to focusing the resources available to the Department for production and use of fuel-grade ethanol from agricultural materials, as a part of the President's program on alcohol fuels and consistent with our other responsibilities.

The President's recently-announced gasohol program for 1980-1990 establishes a goal of 500 million gallons of alcohol fuel capacity to be in place in 1981. About 80 million gallons of annual on-line capacity currently exists; 420 million gallons of additional capacity is therefore necessary to reach the President's goal.

Necessary Federal Incentives

The most important single action necessary at this time to achieve the alcohol fuels production goals is passage of the excise and income tax credits in the Oil Windfall Profits Tax Bill currently pending in Senate-House Conference. The President has recommended that the 4 cents per gallon Federal gasoline excise tax exemption for gasohol be made permanent, and the Administration also supports the 40 cents per gallon income tax credit for alcohol greater than 190 proof (30 cents per gallon for 150-190 proof alcohol) for ethanol produced and used for fuel on farms. These are powerful incentives for ethanol production--the equivalent of $16.80 per barrel of oil. The optional excise or income tax credits will provide balanced incentives which will provide roughly equal assistance for gasohol blends and for lower-proof alcohol produced on farms or by local cooperatives.

It is crucial that the excise and income tax credits be extended beyond the current October 1, 1984, expiration date for the gasoline excise tax exemption. If the tax credits were extended through 1999 as provided in the Senate version of the Windfall Profits Tax Bill, firms and investors considering investments in alcohol fuel plants could expect the return from the tax credits to be available essentially for the amortized life of a new plant.

Economics of Alcohol Production

If these and other Federal incentives are enacted in the pending Windfall Profits Tax Bill and Synfuels Bill, our calculations indicate that, on a pro forma basis, investment in new plant and equipment for fuel ethanol production can show an attractive financial return. Specifically, with $2.50 per bushel corn as feedstock material and other assumptions, a properly-managed, newly-constructed alcohol fuels plant of 40 million gallons annual capacity might be expected to yield a 20-25 percent return on investment. The basic calculations for this are contained in Attachment A to this statement.

The economics of fuel alcohol production can be strengthened by site-specific factors, particularly where the co-products of alcohol production can be increased in value or where production costs can be reduced.

For instance, the integration of an anhydrous alcohol distillery with a corn wet milling plant can result in increased production efficiencies and higher co-product returns (for corn oil, high-protein gluten feed, etc.). The co-location of a distillery with a cattle feedlot can allow the high-protein byproduct to be fed wet, thus saving large amounts of fuel otherwise required for drying the byproduct feed. Similarly, co-location with a cooperative grain elevator can save grain handling costs, co-location with an electrical power plant can use "waste" heat from the power plant, etc.

The remainder of my discussion today will address the specific elements of the USDA alcohol fuels program.

The USDA Alcohol Fuels Program

President Carter's goal for 1981 of 500 million gallons of ethanol is a major challenge--to increase capacity by more than six-fold in less than 2 years. This dramatic increase in ethanol production for gasohol for passenger and commercial vehicles and as direct fuel in farm power equipment will not be easy to achieve. But the USDA is committed to do its part to attain the President's program.

The Department has developed a six-point alcohol fuels program to assist in meeting the President's goal. These are:

- Financial Assistance for Commercial-Scale Plants
- Financial Assistance for Small and Community-Scale Plants
- Management of Domestic Commodity and Other Farm Programs to Include Alcohol Production
- Research and Development
- Technical Assistance for Small-Scale Producers
- Increased Export Sales of Alcohol Byproducts

A copy of the leaflet outlining the six-point program is attached for your information.

Financial Assistance for Commercial-Scale Plants

As a followup to the President's January 11 announcements on the stimulation of alcohol fuel production, the Department of Agriculture on January 19 designated $100 million of Rural Business and Industry loan guarantee authority of the Farmers Home Administration to assist in the construction and operation of alcohol fuel plants. With this authority, we will attempt to place loan

guarantees with firms and persons who can take advantage of the kinds of site-specific factors mentioned previously. We are conducting assessments of opportunities for integrated operation of alcohol plants with corn milling plants, animal feedlots, grain elevators, power plants, and other such opportunities. The B&I Loan Program is based upon FmHA's rural development mission and functions without a "no credit elsewhere" clause.

We estimate that the distillation plant construction assisted by these loan guarantees could provide about 25 percent of the new capacity needed to reach the goal of 500 million gallons of capacity during 1981.

Guaranteed loans for two pilot projects to produce fuel ethanol with advanced technologies had been tentatively approved under the Food and Agriculture Act of 1977. One of the projects has withdrawn, and USDA is replacing it with another to produce fuel.

Financial Assistance for Small and Community-Scale Alcohol Facilities

FmHA is making available a demonstration program of small-scale plants to help those planning to operate fuel alcohol plants at the farm or community level. Loan guarantee assistance for small-scale ethanol production in 1980 is available through the Business and Industry loan program and through an additional $10 million in insured and guaranteed loans from FmHA's Farm Operating and Ownership Loan Programs.

In providing loan assistance for small-scale ethanol production on a broader basis, we want to make sure that it is done in a way that will provide options

for use and marketing of the ethanol produced from small distilleries. Of particular concern is the extent to which it will prove technically and economically feasible to use non-anhydrous alcohol in farm tractors and other farm power equipment--especially since over 85 percent of power fuel use on farms is diesel.

Alcohol production could become a cooperative effort. This would provide farmers an option in that they may either provide grain or other feedstock to a community plant and withdraw needed anhydrous alcohol and distillers grain byproduct for use on their farm, with the remainder being sold for profit; or they could submit farm produced lower-proof alcohol to the community plant for upgrading into anhydrous alcohol for sale or for use on the farm. The amount of product they would receive would, of course, be based on the amount of grains or feedstock they supplied to the community plant.

If this kind of profit-sharing (or fuel-sharing) arrangement is to operate to the maximum benefit of the farmers involved, the community ethanol processing and upgrading plant should be organized on a genuine cooperative basis, whereby the affiliated farmers participate in management decisions, qualify for patronage dividends or other forms of profit-sharing, and otherwise directly share in the cooperative's management and returns. For this reason, we would expect to target loan and loan guarantee assistance primarily to individual farmers and to cooperatively-organized enterprises.

The Department of Agriculture is now in the process of working out a program of financial and technical assistance to small-scale alcohol producers. Because

ethanol may prove to be primarily marketable for blending with gasoline in automobiles, there ought to be facilities in place for the upgrading of lower-proof alcohol to anhydrous alcohol, prior to the widespread construction of on-farm stills with only lower-proof production capability.

For this reason, we may target much of our initial lending assistance on "community" sized plants which have excessive anhydrous production capacity and therefore can upgrade farmer produced lower-proof alcohol, as well as produce anhydrous alcohol directly from unprocessed feedstocks.

Research and Development

The USDA is expanding its research and development efforts in support of the increased emphasis being placed on the production of alcohol fuels from agricultural feedstocks. One of the more important areas for research is the reconstitution of livestock rations to accommodate the increased production of high-protein feed supplement which results from ethanol production from corn. Economic research on agricultural land and water availability and use patterns is also crucial. The Science and Education Administration and the Economics, Statistics, and Cooperatives Service of USDA are placing special emphasis on these and other research and development problems associated with a large-scale U.S. alcohol fuels production effort.

A large component of the USDA research effort involves the more efficient conversion of fuel alcohol from starch and sugar commodities, and from cellulosic feedstocks. The research and testing to increase yields from feedstocks and reduce costs associated with cellulosic materials is particularly

necessary, in order to augment supplies of feedstocks in addition to grain and other commodities during the 1980's. The work on agricultural feedstocks and conversion technology is being conducted primarily at USDA's Agricultural Energy Research Center in Peoria, Illinois, and is carried out in cooperation with work by DOE and the private sector.

The USDA's Agricultural Energy Research Center in Tifton, Georgia, is examining more efficient production, harvesting and conversion of wood and crop biomass for alcohol and other energy forms. They are focusing some effort on systems that can be used on farms and in small communities.

The USDA is also carrying out a research grants program on alcohol fuels and agricultural energy at cooperating institutions. Of $2.4 million funding this year, $1 million will go to alcohol fuel research. Thirty proposals are now being reviewed. Last year six projects were awarded grants totalling $500,000 to improve alcohol conversion technology. The total USDA increase in funding of biomass energy research and development for FY 1980 is about $5.5 million.

In addition to the research efforts of the USDA, the land-grant institutions have on-going projects which are coordinated with and complement the USDA activities. A summary of these, along with a breakout of the increased USDA energy funding on biomass for FY 1980, have already been provided to the Committee.

Management of Domestic Commodity and other Farm Programs to Include Alcohol Production

This alcohol fuels program represents a basic policy change. The USDA now is including production of farm commodities for alcohol feedstocks as a major objective of agricultural policy--alongside the production of food, feed, and fiber. Grain reserve targets, commodity price supports, acreage diversion and other related agricultural policies are being managed to include the grain requirements for alcohol production equally with other consumers of grain.

Since almost 60 percent of the estimated cost of producing ethanol (with corn at $2.50 per bushel) is attributable to the feedstock input, continued growth of the alcohol fuels industry could be largely dependent on future feedstock availability--at a reasonable price.

The production of alcohol fuels will not take precedence over the traditional objectives of agricultural policy--production of food, feed, and fiber--but it will take its place beside them in the administration of farm programs.

Technical Assistance for Small-Scale Alcohol Producers

The USDA is also expanding its technical assistance activities in on-farm and small-scale fuel alcohol production, as a part of the President's program. We have placed special emphasis upon technical assistance to this date, because of the problems of design, marketing, safety, and others that must be handled for successful operation of distilleries at the farm and community level.

Specially trained Cooperative Extension specialists will work with producers on plant design, construction, production, safety, and government regulations to help install and keep small-scale facilities operating.

The Cooperative Extension Service in the various States has prepared instructional materials, conducted seminars, and is preparing to provide more individualized assistance to those interested in local production. Supplementing these materials is a comprehensive technical manual on small-scale fuel alcohol systems prepared for USDA by Development Planning Research Associates (DPRA, Inc.) of Manhattan, Kansas. This will provide more specific details for our technical assistance efforts. This document will be available shortly for public distribution and for use by Federal, State and county staff of the Cooperative Extension Service, Farmers Home Administration, the Agricultural Stabilization and Conservation Service and others.

Increased Export Sales of Alcohol Byproducts

As the production of alcohol fuels is stepped-up, distillers dried grains and solubles will become increasingly available. To avoid if possible an oversupply of DDGS and the possible depression of prices of other protein supplements such as soybean oil meal and cottonseed meal, USDA's market development staff is already looking into the foreign market potential for DDGS and is working with cooperator groups to expand exports.

This USDA alcohol fuels program is being done in collaboration with other Federal agencies including the Department of Energy, Treasury Department--Bureau of Alcohol, Tobacco and Firearms, Community Services Administration and the Small Business Administration.

The USDA and the Department of Energy have been developing a program Memorandum of Understanding which would transfer a portion of DOE's Biomass energy program to the USDA for management and operation. Some $12.8 million of passthrough funding for FY 1980 would be involved. We will be pleased to keep the Subcommittee informed of progress on this matter.

The Committee inquired about efforts by USDA to integrate alcohol fuels into the total farm systems. Our emphasis on small and community-scale facilities is designed so that the individual farmer, either on his own farm or in a community facility, may use his own labor and feedstock to produce alcohol fuels, and then to use the alcohol fuels on his farm as well as the byproduct high-protein feed. This should provide the farmers with a much higher degree of energy and feed self-sufficiency than is currently the case.

We are also examining the potential impact of fuel ethanol production on cropping patterns, farm size and structure, and other aspects related to the structure of U.S. agriculture. This is being done within the context of Secretary Bergland's overall focus on the structure of American agriculture and the impact of alternative policies and programs on structure.

This ends my prepared statement. I will try to answer any questions that you might have.

ATTACHMENT A

Estimated End-of-1979 Economics of a 40 Million Gallon Per Year Grain Alcohol Distillery

(With Federal Subsidies Only)

	Dec. 1979
Feedstock costs ($2.50/Bu. corn)	$ .98
Direct costs (fuel, labor, etc.)	.26
Indirect costs (administrative, marketing, plant overhead)	.10
Capital recovery (includes 15% ROE)*	.34
TOTAL	$1.68
Less distillers' dried grain byproduct credit ($116/ton)	-.38
	$1.30
Less Federal Gasoline Tax credit	-.40
Less Other Federal incentives (investment tax credit; entitlement credit)	-.08
NET PRODUCTION COST PER GALLON OF ETHANOL	$ .82

	Gasoline	Ethanol
Refinery gate price on non-lead gasoline	$ .85	--
Octane credit	.10	--
TOTAL	$ .95	$ .82

ESTIMATED PROFIT PER GALLON ETHANOL, IN ADDITION TO 15% ROE** $ .13

*The capital recovery estimate assumes a 15 percent after tax return on equity, 70 percent equity financing, and 12 percent cost of credit. The 13 cents estimated profit per gallon, factored into capital recovery, would yield about a 20-25 percent after-tax return on equity. Additional state subsidies would increase the rate of return

** Return on Equity

Mr. GORE [presiding]. Mr. Miller.

STATEMENT OF DR. BENNETT MILLER, ACCOMPANIED BY STEVE POTTS

Dr. MILLER. It is a pleasure to be here. In the interest of time, I, too, would like to summarize my statement so we can get to the questions. What I would like to do is describe to you the activities presently being supported in the office to support the use of alcohol fuels.

Sitting at my left is Mr. E. Stevens Potts, the Acting Director of the new Office of Alcohol Fuels. I think that is a major development in the Department, not only identification of an office devoted to the whole problem of alcohol fuels, but furthermore the identification of Mr. Potts as its Director. He has been involved in this program for some time. I think he brings a great deal to that office. He is moving rapidly to move the process.

Before I describe some of the initiatives DOE is taking in this area, I think it appropriate to talk about some of the major issues. First, there is the question, and it tends to be the one on which most people focus, of the net production cost of ethanol. It is still more expensive than unleaded gasoline. On the other hand, with the excise tax exemption and with some of the State excise tax exemptions, we believe that in many cases the production costs of ethanol now are competitive with unleaded gasoline.

As Mr. Williams pointed out in his testimony, it looks very favorable. That is very encouraging, and I think it speaks strongly for the extension of that exemption beyond the present expiration date.

The second issue is the issue of net energy balance. Mr. Gore, I was sitting here when you made your remarks, and I agree. I would use your words, "it is a red herring." The only question we have to worry about is whether or not we are burning oil to make ethanol. If we do that, then we really have to look twice, because almost any process is going to lose you energy overall, and we simply do not want to burn oil to make ethanol to put back into gasoline to burn again. So it is an issue on which I could not agree with you more.

The next issue is food for fuel. DOE has concluded that by using distressed crops and excess crops the near-term alcohol production demand can be supplied without a negative impact on fuel production.

Finally, there is the very important issue of the adaptability of ethanol for use in vehicles. There is no question that gasohol works and works quite well. I would bet that everybody here in this room has tried gasohol in his car. It has virtually no impact on performance, at least not that I can determine in my own driving experience. The questions we worry about are whether or not ethanol can be used in diesel engines and if it will have real farm impact. We are taking a hard look at those questions to resolve any uncertainties in that area.

I would like to talk for just a few minutes about the U.S. Department of Energy's program in alcohol fuels, because I think it is important in the context of the President's overall program. As you know, that program, as Mr. Williams has described, involves the

permanent exemption from gasohol of the 4-cents-a-gallon excise tax, the 4-cents-a-gallon tax credit, $3 billion of Federal credit programs, a billion dollars in the energy corporation for biomass, and a series of other incentives which over the next 10 years we estimate will involve between $9 billion and $13 billion either deferred or direct expenses for the production of ethanol.

To meet the 10-percent gasohol goal which the Department has established for 1981, we are involved in a number of activities that impact near-term markets. All of these programs will be administered through the Office of Alcohol Fuels. These programs provide direct assistance using funds from the demonstration program, and provide information to potential users to stimulate alcohol production in the short and long term. The project will be initiated shortly in connection with TVA to demonstrate operation of small-scale stills on farms in the TVA region. There is another operation in Idaho Falls, an ethanol plant. That design information will obviously be made available to the public. We think this is one way of addressing some of the concerns I heard as I was sitting in the audience regarding the lack of availability of proven designs and designs that we can rely on to produce the ethanol we need.

The Office of Alcohol Fuels in addition will be responsible for evaluating the administration's fuels program. We believe in the coming months we will see major movements to fund both feasibility studies and loan guarantees out of that appropriation. From the point of view of the Department of Energy our biomass program has in the past spent a fair amount of money for developing proceses that would lead to ethanol fuel. That program has been primarily of an R. & D. nature and is focused almost exclusively on the longer term prospect for ethanol production; in particular, the conversion of lignocellulosic products to ethanol and wood to ethanol. We heard this stated quite forcefully this morning. The process for turning grain to alcohol is common knowledge. What we do not know is how to take cellulosic material and convert it to alcohol. Our program has been aimed essentially at addressing that program.

In addition, in the Department, there are programs outside of biomass, small ones in the appropriate technology program. There is a program in Conservation under the alternative fuels transportation effort. There is a small program in the Office of Consumer Affairs which sponsors educational and training services. Then there is an urban waste program also supportive of the alcohol fuels program.

In summary, Mr. Chairman, I feel we are making clear and significant progress, not only in the R. & D. phase but departmental. The Department clearly recognizes this is an area of great visibility and interest and something that needs to be moved quickly. There has been rapid movement on our part to staff Mr. Potts' office. I think we are taking very forthright measures to meet some of the program needs and some of the concerns as expressed here and concerns that we have expressed outside of this meeting room.

Thank you.

[The prepared statement of Bennett Miller follows:]

Statement of Bennett Miller
Before the House Science and Technology Committee
Subcommittee on Energy Development and Applications
February 22, 1980

Mr. Chairman and Members of the Subcommittee

I am pleased to be here today to describe to you the activities of the Office of Conservation and Solar Energy in DOE to support the development and use of alcohol fuels. DOE will be working intensively to develop what we now recognize to be the significant near-term potential for alcohol fuels to displace a small but important portion of the petroleum used for transportation in this country. Initiatives already underway or proposed under this Administration are designed to accelerate the production and use of alcohol fuels in the future with special emphasis on the next several years.

Before I describe these initiatives, however, I think it is useful to review our current understanding of several important issues surrounding the use of alcohol fuels, especially gasohol, a 90%/10% blend of unleaded gasoline with alcohol. Net production costs for ethanol (after credits for the sale of by-products) are still higher than the price of unleaded gasoline. With existing federal incentives, the economics of ethanol production are favorable. As the world oil prices continue to rise the economics of producing alcohol will improve further. For example, the U.S. production of ethanol fuels increased from next to nothing 18 months ago to 80 million gallons per year at the end of 1979 in large part, we believe, because of the 4 cents per gallon federal excise tax exemption. Furthermore, a number of states have taken action on their own initiatives to suspend state excise taxes, in some cases up to 9.5 cents per gallon in addition to the 4 cent federal exemption. The President's recently announced program to extend the Federal exemption and provide additional incentives for ethanol production will further improve its competitive position. I will discuss this program in more detail later in my statement.

Another important issue for alcohol production is the net energy balance of the processes. While this figure is highly dependent on the specific system being used, and the heat source for the fermentation and distillation processes, numerous studies have concluded that the net energy balance of typical systems is positive although small. In this context I would like to state that the net energy question, while important, is oftentimes over-worried. The generation of electricity is a net energy "loser", however, that does not mean that we should stop generating electricity. We simply value the product highly and, therefore, pay energy penalties to get it. Similarly for ethanol, we may be willing to accept energy penalties to produce a premium fuel. Moreover, if we are burning renewable fuels or coal to produce the alcohol the exact energy balance becomes less important.

As the production and use of ethanol/gasohol expands, the issue of potential competition with food production and other traditional agricultural practices will demand greater attention. DOE has concluded that by using distressed crops, crops from marginal lands, excess crops and wastes such as food processing wastes, the bulk of the near-term alcohol production demand could be supplied without negative impact on food production. In addition, the by-product of alcohol production (distillers dried grains) can be recovered and used as a high-protein livestock feed. These benefits are beyond the obvious ones of displacing petroleum-based liquid fuel use on farms, and of assuring farmers of local fuel supplies sufficient to plant and harvest their crops. Even where marginal lands must be brought into production or new specialized high-yield crops introduced to provide additional feedstocks, benefits to farmers may include product diversification, improved soil fertility, and reduced requirements for petroleum-based fertilizers, pesticides and herbicides. While these activities may significantly modify cultural practices on the farm, the net effects are expected to be positive.

While the feedstocks are expected to be available without significant effects on food supplies or prices, current production capacity for ethanol is small. An important issue currently being addressed at DOE is the need to stimulate the rapid expansion of this production base. Most of the existing production capacity was designed for beverage ethanol. The limited excess capacity in this industry will have to be retrofitted for distillation to close to 200° proof (water-free) ethanol for fuel use. Maximizing ethanol production to achieve national goals will require production in small units on farms and by farm cooperatives as well as new larger plants. The larger facilities will require as long as several years for planning and construction. Consequently, small units which can be brought into operation relatively rapidly are now receiving greater attention. DOE is currently attempting to provide the information and technical assistance necessary to bring these small systems "on-line" through activities I will describe in a few moments.

A final issue of great importance to the consumer is the adaptability of ethanol for use in existing vehicles. Gasohol is being used in present automobiles without modification. Minor impairments to drivability such as hesitation and stalling when cold do occur in some vehicles. However, the overall operation is essentially unchanged. Pure ethanol can be used as a motor fuel in internal combustion engines with minor modifications, and may be especially desirable in farm equipment. Diesel engines have been operated on ethanol and diesel fuel mixes with alcohol contents as high as 50%. However, more work is planned in this area to define better the optimium method of injecting ethanol in diesel engines. For instance, recently we initiated a project to determine the best method for ethanol use in diesel farm equipment.

These, then, are some of the key issues associated with broad scale use of fuels using ethanol that DOE is addressing. The Biomass Energy Systems Program has until recently been the central focus for all alcohol-related research, development and demonstration activities for the Department. Earlier this month, an Office of Alcohol Fuels was established in the Office of Conservation and Solar Energy under my direction as Deputy Assistant Secretary for Solar Energy. This Office, working closely with the Biomass Program on their ongoing alcohol activities, will run the alcohol programs, plan new initiatives, and manage new programs as requested by Congress and the President. We are currently working out the planned budget for Alcohol Fuels. Sitting here with me this morning is Mr. E. Stevens Potts, the new Acting Director of the Office of Alcohol Fuels. Mr. Potts has been given full authority to organize this new Office and to develop an overall program plan in this very important area.

One new alcohol program that will be addressed in the Office of Alcohol Fuels is the gasohol initiatives program announced by the President on January 11th of this year. This program had been designed to stimulate a target of quadrupling of the current gasohol production capacity by the end of the year and, if successful, will result in an annual production rate capability of 500 million gallons during 1981. This level of production could replace nearly 10 percent of our anticipated demand for unleaded gasoline with gasohol in 1981. The DOE Biomass program is but one part of the Administration's actions to promote the use of Alcohol Fuels. Key elements of the President's program include:

- o Permanent exemption for gasohol from the 4 cents per gallon federal gasoline excise tax.
- o Forty cents per gallon production tax credit.

- o $3 billion federal credit program.
- o Energy security corporation programs for biomass.
- o Revision of the entitlements program.
- o 10% investment tax credit.
- o Using gasohol in federal vehicles.
- o Farm program management.
- o Alcohol production research and development
- o 500 million gallon target.

Under the gasohol program recommended above, federal expenditures (tax and outlays), including direct loans and loan guarantees, would range between $8.5 billion to $12.8 billion for the period 1980-90.

To meet the 10% gasohol goal the Department is engaged in a number of activities impacting near-term markets which will be run by the Office of Alcohol Fuels. These programs provide direct assistance using funds from the alternative fuels demonstration program to parties financing alcohol related projects; provide information to potential users and producers; and support research and demonstration activities to stimulate alcohol production in the short-and long-term.

The Office of Alcohol Fuels is managing a number of system demonstration and information dissemination activities. A project will be initiated shortly in cooperation with the Tennessee Valley Authority (TVA), to design, demonstrate and evaluate the operation of small scale stills on farms in the TVA region. Another project to be managed by the DOE field office in Idaho Falls will develop designs for and test a 150,000 gallon per year ethanol plant and will subsequently make detailed design information available to the public.

The Office of Alcohol Fuels will also be responsible for evaluating and administering those portions of the Alternative Fuels Demonstrations Program (P.L. 96-126) applicable to ethanol production from biomass. Regulations are now being completed to distribute the Program's $2.2 billion appropriation. The appropriation includes $100 million for feasibility studies, $100 million for cooperative agreements, $500 million for loan guarantees and $1.5 billion for purchase agreements. On February 25 a solicitation will be sent out for feasibility studies and cooperative agreements. Sixty days will be allowed for the publication response, and sixty days for DOE to evaluate and announce contract awards. It is anticipated that loan guarantee money will be available later this spring. The share of money to be spent from the alternative fuels demonstration program on ethanol from biomass will be determined once responses to the solicitations have been evaluated. Public interest in this program, especially the Alcohol Fuels aspects, has been extremely high.

This Office is informing the public and interested investors on the production and use of alcohol fuels. On February 4, 1980, DOE designated the Solar Energy Research Institute as the National Alcohol Fuels Information Center. The center provides technical and financial information on the production of alcohol fuels. A toll free number, (800) 525-5555 is in operation for public inquiries.

The Office is also developing materials aimed at answering the most frequently asked questions regarding alcohol production. The principal document at present is the manual for small scale alcohol production entitled "Fuel From Farms" developed by the Solar Energy Research Institute at DOE's request. 200,000 copies are available for public distribution through the Technical Information Center at Oak Ridge, Tennessee.

A key to future capacity expansions and cost reductions in alcohol production is research and development on technologies to make alcohols. The Biomass Energy Systems Program has a comprehensive research and development program for ethanol production. Efforts are currently underway in FY 1980 to improve the process efficiency of existing fermentation systems and to expand the use of higher yield crops such as sweet sorghum. Investigations of production systems are using herbaceous species screening studies, specialized energy farming techniques, and studies of sugar cane and tropical grasses to improve yields. Conversion systems are also being developed to use relatively more abundant and less expensive lignocellulosic agricultural and forest residues to produce ethanol and methanol. When this technology becomes economical on a commercial scale, the food vs. fuel issue will be significantly diminished. Finally, long-range research and development is underway to develop advanced production and conversion methods that will improve yields and lower costs.

During FY 1981, feasibility studies for the growth of sweet sorghum will be completed. Additional emphasis will be placed on bringing energy production capacity "on-line" using the Alternative Fuels Demonstration program as well as Biomass program funds. Work will continue on developing methods of pretreating cellulosic materials for fermentation. Methods of improving the fermentation process including better microorganisms, more effective product separation and process efficiency studies will be studied. Projects will continue to discern effects of alcohol blends on the internal combustion engine.

Research related to ethanol will also be underway in other sections of DOE in FY 1980 and FY 1981. A few of the key activities to be coordinated with the Office of Alcohol Fuels include:

- The Small Scale Appropriate Technology Program -- Provides grants of up to $50,000 to develop, demonstrate, and encourage the use of energy-related small scale technologies that use renewable resources, such as ethanol from Biomass.

- The Alternative Fuels Transportation Utilization Program -- Provides competitive awards in research, development and testing of alternative fuel uses in transportation systems. The DOE fleet testing program on gasohol and other alcohol fuels is part of this Office. The aim is to develop technology to support reliability testing and demonstrate the use of straight alcohol fuels.

- The Office of Consumer Affairs -- Sponsors educational and training services to individuals interested in small scale systems on farms.

- The Urban Waste Program is an R&D program studying the conversion of urban and municipal waste products to energy including ethanol. This program will also participate in the Alternative Fuels Demonstration Program (P.L. 96-126).

Finally, I want to assure the Committee that we are working closely with USDA and other Federal agencies in developing this program.

In summary, I feel that we are making clear and significant progress on several fronts related to the production of alcohol from biomass to provide an alternative transportation fuel at a reasonable price. The key to this will be the President's program as described earlier in my Testimony. I believe our recent reorganization to establish an Alcohol Fuels Office and our acceleration of near-term activities in that Office will show meaningful results in the market place within 18 months.

This completes my prepared testimony. I will be happy to answer any questions you may have.

Mr. OTTINGER. Mr. Potts.

Mr. POTTS. I consider this job a tremendous challenge. We are looking forward to working with our colleagues in the Department of Agriculture. This is the first synthetic fuel the American public will have an opportunity to use. It is our opportunity to show them that it is a very viable fuel. We are very excited about that. I believe the future of alcohol right now is actually in the hands of the folks right here in Congress. Unless we have a solid windfall profits tax, unless we have an energy security corporation with the money for the funding of the plants, I think that the industry will not grow at the rate we hope it will. But I do think we have a very positive start here, working in partnership with the Congress.

I would be happy to assist Dr. Miller in answering any questions.

Mr. OTTINGER. We apparently are not going to have that energy security fund the way the windfall profit tax is being handled in the conference. They are going to set aside a certain amount for energy which we will have to then authorize and appropriate. If that is so, we have to take a look at how we will mesh it with existing programs and be able to act fast enough to use some of that money in fiscal 1981. At some point, we ought to sit down—I do not know the extent to which this affects the Department of Agriculture—but I would like to sit down with the people in the Department of Energy and work out a strategy, maybe we should include the Office of Management and Budget as well. So many of the advances in energy programs which we are dependent on will require funds from that energy fund. We are not sure how we can handle that in terms of our current budget bill. We could do two budgets, one to tap the funds from the tax and one to tap the general revenue funds raised otherwise. It is really something we are going to have to address very, very soon.

Dr. MILLER. If there is a significant change to that, we will want to take a relook.

Mr. OTTINGER. Is anybody in the Department specifically addressing that problem as yet? Is Deputy Secretary Sawhill?

Dr. MILLER. All I can tell you from our point of view, we are keeping our fingers crossed.

Mr. OTTINGER. The budget process is moving right along. We really need an emergency session to thrash those problems out.

Mr. WILLIAMS. Mr. Chairman, let me respond to that. Perhaps while you were out of the room I alluded to a meeting I had with John Sawhill last night. We are trying to put together a position that would make some sense in how to distribute those problems. There are two basic questions which have to be addressed; the question of whether DOE will have lending authority is a Presidential and congressional decision. But assuming that comes to pass, I do think that it would be very possible for the OMB, the Department of Energy, the Department of USDA, to work out some mechanism to deal with it, simply on the basis of demand.

There are a number of ways to do that—one is on feedstock basis—where clearly we have no expertise or delivery system for municipal waste as a feedstock. If it is in the food and fiber area where we have the conventional lending authorities under other than the windfall profit tax, we have that. We would have no

hesitancy in working with the decision of the Congress or President as to lending authority.

What I would not like to do is preempt the field so in essence we make only on-farm lending. This would mean for the most part, small scale, less than anhydrous production. Even if the technology were there so we could satisfy ourselves that on farm production at 190 proof with the 30-percent tax credit built in would be utilized, that would not present a real problem. My concern is with the state of the art as to diesel engines. If they cannot use all the farm alcohol at the farm level, then there needs to be the secondary market which is unleaded gasoline, and requires an anhydrous product. We are trying to package whatever we do in USDA so that on-farm production has a secondary market through an anhydrous unit. To do that I think we must have the ability to meet that problem either through the conventional lending we now have or windfall profit tax provisions.

Mr. GORE. Will you yield, Mr. Chairman?

Mr. OTTINGER. Yes.

Mr. GORE. Are you aware of the new diesel process?

Mr. WILLIAMS. I have not yet seen anything, Mr. Gore, using a direct alcohol fuel.

Mr. GORE. It is a two-jet separate feed.

Mr. WILLIAMS. I am told there are some things—in fact the M. & W. Gear Co. is the most recent I have read about. If I recall the figure, it uses something less than 150 proof.

Mr. GORE. That is one of the virtues; it can use low-proof alcohol.

Mr. WILLIAMS. That 150 proof to 180 is a 30-cent tax credit to the farmer. If it is going to be used at less than 150 proof, there should be some sliding scale on the incentive tax credit.

The other point I would raise with you is, in time I think we will be able to use a tremendous amount of alcohol in diesel engines, but even the M. & W. report I read indicated a conventional tractor would operate efficiently with the jet feed mixing water and alcohol before the turbocharger and after the conventional engine at a 1 gallon alcohol to 8 gallons of diesel ratios. But even on the original tractor, you were burning about 8 gallons of diesel, so that is a very limited use for the farmer of his own diesel equipment.

Mr. GORE. One out of eight is even better than the 1 out of 10. That is even better than the one in gasoline.

Mr. WILLIAMS. I won't argue with that, but what should the farmer do with the extra he produces on his farm, and shouldn't he be able to get it into an anhydrous state and into the market for the farmer's protection of amortizing his debt?

Mr. GORE. I thank the chairman for yielding.

Mr. OTTINGER. As I understand it, from a gentleman who has been much involved in the alcohol field, Mr. Pincas Jawetz, the Department has not yet decided on a diversion or set-aside program for 1981.

I would like to know whether any consideration is being given to using the funds that would be used for a set-aside or diversion for the subsidization of alcohol production. In particular to grow those crops that would not otherwise be grown in order to move faster on a fuel program.

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Mr. WILLIAMS. I wish I knew the answer to the decision that we are making next Friday. A week from today there will be an announcement. Our problem is a rather complex one, and I won't try to go into all of the detail about the economic analysis on a paid diversion program, but simply put forth those on the Agriculture Committee; we have no authority now to go with the set-aside.

The only option open to us is the paid diversion which takes two things into account. One is the total production of feed grains next year, the 1980 crop year, and if we were to have a crop of the size we just had, the largest we have ever produced of corn, we would have an increase in our inventory and probably be a depressant on the market for the 1980 crop.

If we have a yield as low as we had less than 5 years ago, we would use up all of our reserves and not have any carryover for next year. Now, what we are trying to do is guess what the weather is going to be, and whether we will produce 90 bushels per acre, or 100, or 110 as we did in the current year just concluded.

The other side that needs to be discussed, and this is perhaps not the right committee to deal with it, is the management of cash flow for farmers. A paid diversion would give a farmer an opportunity to take some acreage out of production, get paid for it now, and have that cash to help defray the costs of putting in the balance of his crop.

It does work to help stimulate development and to get financing, where credit is extremely tight in rural America, and small lending institutions have very high interest rates. With competition on those banks for their money at very high interest rates, we do have a credit crunch that is a part of the decision, and we clearly have about 65 million acres more in crop land than we had in 1970, and some of it is quite erodable land.

If we have a diversion it would be our desire to take as much of that erodable land out of production as possible.

Mr. OTTINGER. The subcommitttee was just down in Brazil. Brazil has a massive effort going to replace their gasoline. Commensurate with that activity they are working on replacing diesel with fuel from agricultural crops. They are consciously planting millions of acres in sugarcane specifically to go into fuel.

We have many more cars, they have about 6 million cars, and I understand we have about 110 million cars. If we are going to make a real dent in fossil fuel use for cars, which is the principal source of our dependence on foreign oil, then it seems to me we just have to start thinking in terms of doing a similar program ourselves.

Sugarcane is a very advantageous product for alcohol, because you use the bagasse as the fuel. There are a number of other agricultural crops that lend themselves well to the purpose. For example sorghum may be even better than corn.

Does the Department of Agriculture have an actual program to start raising or encouraging the raising of crops specifically for fuel, in order to get us moving on something like the same track the Brazilians are?

Mr. WILLIAMS. Yes, sir; we have two things that I would comment on. We have hundreds of crops being analyzed at the Agricultural Research Center in Perioa, Illinois, for our ability to convert

to ethanhol. We have a tremendous wood activity going in Madison, Wisconsin, which deals more directly with cellulosic conversion, and if what Energy has said here is the major problem, we can convert, provided this has no lignin.

A third of the cellulose is lignin and our present enzyme treatment has not been successful in breaking lignin down. We have a further research project with DOE and Dr. Tsao at Purdue University working specifically on sugarcane. One of the pilot projects we have approved under the 1977 act is the project of Savannah Foods and U.S. Sugar which is dependent on the project at Purdue.

We are interested in it. As I said earlier, when you were out of the room, we were making a demand on corn for alcohol fuel, the same as if it were for livestock or food in establishing agricultural policy, but to give your perspective, if we achieve the goal that we have outlined in 1981 of 500 million gallons, we are still talking in terms of only about 5 million tons of corn, so it is a relatively small part of the total agricultural production at this point.

Mr. OTTINGER. My question is why? I am all for the research. This committee authorizes funds for a good deal of it. I think there are some areas of the research that are ready to move out, into the market and I am very anxious to do that this year.

What I don't understand is why we don't really move rapidly into doing those things that we can do now while we are researching on the next step.

Brazil is doing a lot of this research too. For example, they are looking at palm oil as a substitute for diesel fuel. They are developing palm plantations for that purpose, and they say you can get three times the amount of production of palm oil per acre as you can get from sugarcane. Overall their approach seems to me to be more comprehensive.

They said, we have this terrible oil import problem and it is ruining our economy, so let's go do something, even though it involves some risk. So they are planting millions of acres of sugarcane. They are actually doing it. They have their whole country on 20 percent alcohol, and will go to 100 percent alcohol by 1990.

They have a mission of getting the crops going, and building the distilleries with the existing technology. I don't see anything comparable to that in this country. Why can't we get started today?

Mr. WILLIAMS. I think we can. And two things that have been happening since I have been here for 1 year that are significant. Nothing much happened, I must say, for the first 3 to 5 years that we faced the OPEC problem, but last year we saw a deregulation of domestic oil which in essence begins to make the whole alternative fuels issue more viable economically. You can do a lot of things when you no longer have a cheaper oil policy.

The other is the doubling of oil prices on imports in the past year which made alcohol, even from corn at $2.50 a bushel, provide an economic return on equity capital.

The third thing, though, that is missing, is a known tax policy by the Congress on what it is we are going to do. Loan guarantees will be helpful, but the big money in my opinion in the investment into corn for alcohol is going to come to the private sector. For example, the Archer Daniel Midland operation, is making three byproducts

aside from alcohol in a wetmill process and the economics of that has simply been much enhanced.

The thing that I think will enhanse alcohol production is if the Congress passes a conference report in the form similar to what it is now, extending the 4-cent tax credit for 10 years, giving them 10 years to amortize their plant with a known subsidy and double the investment tax credit from 10 to 20 percent. If so, we are finally reaching that point where the country is willing to make a commitment.

I was in an elective office for the last 10 years in Florida before I came here, and I supported, as a Democrat, Nelson Rockefeller's $100 billion research and development program.

I was a long way from Washington, and am glad I would not have had to have balanced your budget, but yet I think there has not been a commitment on the part of the American people, and as bad as it is, the Iranian situation topped off by the Afghanistan situation, has demonstrated to the American people that we have a very serious problem. I find as I travel now much more commitment to this issue of alternative renewable energy resources than was ever there before.

Mr. OTTINGER. I certainly find, and I think my colleagues find, that what the American people are really waiting for is leadership, a program to be presented to them. Contrary to some views, I think that they are willing to make sacrifices to achieve independence.

There was testimony this morning where the stations are selling gasohol at 8 cents a gallon higher than gasoline. The stations are finding that 70 percent of their customers are choosing the gasohol, just because they want to make a contribution.

Mr. WILLIAMS. We feel so strongly that the Congress is going to act and while you were out of the room I cited the figures. We set aside $110 million in Farmers Home in the 1980 budget for the purpose of moving out with an initiative and the greatest thing that would help us to make those loans now is to know that there is going to be this subsidy available with a new 30 cent tax credit, so that a farmer can in fact pay for what we guarantee or make direct loans on.

Mr. OTTINGER. One last thing, we had a Mr. Don Patterson from the American Agriculture Movement here, and he said that the farmers are prepared to go and do this. Rather than any kind of grant area, the subsidy program they really needed was money, at an interest rate they can afford to borrow. I was under the impression that the agriculture programs included low interest loans.

Mr. WILLIAMS. Their cost of money went up. In January the cost of money for Farmers Home was 10¾ percent, between that and 10½. It is not considered cheap money, but it is far cheaper than what I am having to borrow to keep my orange grove growing in Florida from a commercial bank.

My only personal concern is that if a farmer is going to invest in a loan, I would sure urge him to have a secondary market. Then he is sure to get that tax subsidy available of 4 cents a gallon of gasohol which is 40 cents a gallon of alcohol and $16.40 computed at the barrel level, if he can't use it all on his own farm; and I am not yet satisifed that full farm utilization of an alcohol still is possible with today's technology.

I hope that we can break that barrier quickly but, as you told me, even Brazil is having great difficulty in getting enough diesel to keep its trucks, buses, and tractors running.

Mr. OTTINGER. That is their prime problem down there. As I say, they are moving on that now. I just think it is essential we get moving.

Mr. Gore?

Mr. GORE. Thank you, Mr. Chairman.

Mr. Williams, are you familiar with the Farmers Home effort to evaluate the expended new on-farm units and give a seal of approval to one or more of them?

Mr. WILLIAMS. Yes, sir; we are working with DOE on that also. We are not trying to be in-house experts on technology. We really believe DOE has the technical responsibility even on conventional loans that we have to deal with. We are not staffed up in the same way to deal with the technical side of evaluation of plants, but in concert with DOE we are prepared to do that.

Mr. GORE. Mr. Miller, are you familiar with those three companies that are trying to get salable units that meet reasonable standards on the market by April?

Dr. MILLER. No, sir; I am not.

Mr. GORE. OK; this is one of the people from the Commission who has been working with those companies.

Mr. WILLIAMS. Mr. Barton is our Office of Energy Director, and he tells me that there are any number that are in that process of trying to get approval.

We will do whatever we can on any specific case that you will identify to be sure a timely decision was made.

Mr. GORE. I sense a new awareness within both USDA and DOE of the importance of this technology. I appreciate the assistance that both the Departments gave to me last weekend in putting on this gasohol workshop, but I must say that I think that a lot more obviously needs to be done.

Both Departments have come a long way in the last year, and I think there is agreement in the Departments that you all have got to do a lot more.

For example, Mr. Williams, I wonder if you could tell us how much alcohol you could estimate has been produced as a result of the USDA?

Mr. WILLIAMS. Very little.

Mr. GORE. Any at all?

Mr. WILLIAMS. Well, we have approved some projects, and we will be glad to supply you with a tabulation of those that have been completed through the Farmers Home Administration.

We have also recently approved in North Carolina something that is just as important. It happens to be a wood pelleting operation where we are replacing natural gas or crude oil for boiler fuel which in essence frees that up for liquid petroleum, and the potential for wood products is massive, we think maybe even larger than the corn conversion ability over the longer term.

Mr. GORE. Has USDA done any research on the use of mash, the best mixtures using mash and feed to get the maximum grain from livestock?

Mr. WILLIAMS. We have not done the kind of work that I think is absolutely necessary.

Mr. GORE. Has USDA done any research in this area?

Mr. WILLIAMS. We have done some, and we are asking the Farmers Home to take into consideration in its lending program the location adjacent to a livestock operation.

We have recently approved a loan that is contingent upon the research and development technical feasibility through DOE and the private sector for Lamar, Colo., which would have put the feedlot right into production with methane gas, and we also would like to locate as many alcohol plants in proximity for on-farm, for livestock feeders.

It would be very bad for a person in Iowa who is not in the livestock industry to choose to get into the alcohol fuel, business and the guy with the livestock not be a part of that action. You have got to locate a small still where the wet mash can be fed directly to cattle or other livestock.

Mr. GORE. Well, I hope that USDA can provide the farmers in my district and elsewhere in the country with some answers to those questions about what mixtures are best, what is the maximum weight gain. If we are going to feed the distillage, how should we go about it? I hope we can get those answers coming some time soon.

Mr. WILLIAMS. We are supposed to have that data in the Farmers Home booklet that is being sent to every county office. I will follow up with the Science and Education Administration, and perhaps we can communicate with you on specific data that we have now.

Mr. GORE. I was told Saturday that that booklet is going to be at the Farmers Home office within 30 days. Is that correct?

Mr. WILLIAMS. Yes.

Mr. GORE. Both of you have talked about the importance of congressionial decisions. Let me just say that the windfall profit tax conference has crossed that bridge, and you can write that down and put a checkmark by it.

That exemption is going to be there until 1992. I am a member of the conference committee on the synthetic fuels part of the program, and although the final compromise is not yet clear, there is going to be a substantial amount of new money for loans and loan guarantees and other forms of stimuli for gasohol production, but the administration is going to have to make some decisions too, and they are going to have to get their priorities in order.

The Department of Energy, for example, requested a $30 million supplemental for fiscal year 1980 in line with the announced goals. What happened to that request, Mr. Miller?

Dr. MILLER. It was submitted to OMB and initially it was turned down. It has been resubmitted by Mr. Sawhill and Mr. Deutch directly to Mr. McIntyre, and at present it is back in OMB and still under consideration.

Mr. GORE. Who was the official at OMB that initially turned it down?

Dr. MILLER. I don't know.

Mr. GORE. Was it somebody under Mr. McIntyre, if he didn't see it?

Mr. WILLIAMS. I was not a part of that.

Mr. GORE. What reasons did OMB give for cutting that request to zero?

Dr. MILLER. Basically the supplemental tends to be aimed more at the longer term R. & D. activities than it is at the very near term kinds of programs that we are looking at in the President's initiative.

Mr. GORE. You mean the Department of Energy plan to use that $30 million supplemental on long-range R. & D?

Mr. POTTS. If I could handle that, sir, the supplemental was intended to answer some of the basic questions that have been raised here today. It was intended to do the R. & D. on the process of the entire chain of producing alcohol beginning with growing the crops and going all the way through putting it into the automobile.

It was intended to stimulate each of the R. & D. development programs in an aggressive manner, so we had examined each area of the production chain to find out the best answers as quickly as possible for 1980 and 1981.

Mr. GORE. So it was directly aimed at meeting the President's goal?

Mr. POTTS. I would say it is more aimed at getting the best answers to the technologies. It was not specifically directed at the goal itself, because we feel the goal is going to be met. Even though the R. & D. development money may not become available to us, I think we have a good start on that because of the cooperation of the Congress and the intensity of the people in the country today.

Mr. GORE. If you get a farmer knocking on your door and maybe he has several neighbors who want to go with him, you might——

Mr. POTTS. We had over 10,000 knock on our doors at the two information offices, and I have had 300 phone calls in 1 day myself right after the President announced his program.

Mr. GORE. Let's take a hypothetical farmer instead of one of those really knocking on your door and, if you want to, you can assume that he has got a couple of neighbors that will go in with him.

Now, are you going to advise that person or that small group to try to find blueprints and construct their own unit or point them in the direction of some company that they can buy a unit from?

Mr. POTTS. Well, the first thing we do with any farmer that comes to us is tell him everything that is available in Washington today. We have a book. "Fuel From Farms," to inform him.

Mr. GORE. I want to know about the unit.

Mr. POTTS. We have in there a list of all of the manufacturers we have available who deal in small-size units.

Mr. GORE. Do you certify that they are selling good products?

Mr. POTTS. Not at this time, but we do have a project going on right now to develop designs for small units that are certifiable.

Mr. GORE. When will that be completed?

Mr. POTTS. We hope within about 2 months. It takes quite a bit of effort.

Mr. GORE. Right now you point them in the direction of the markeplace and you tell them, "Take a risk."

Mr. POTTS. I won't say I am exactly telling them to take a risk. I show them what we have available and explain the risk. There is an economic analysis procedure in the "Fuel From Farms" book

that lets them determine on their own whether or not they should get into this business.

We tell them every bit of information we can, and we make them aware of the risks.

Mr. GORE. Wait a minute. Would you recommend to that person that they try to get a plan or blueprint and build a unit, or would you recommend that they roll the dice and try one of the manufacturers that are selling units currently?

Which way should they go?

Mr. POTTS. Personally, I would not like to speak at this time on whether I would tell them to go to a specific manufacturer. As I told one such person yesterday, I can't recommend a specific manufacturer at this time.

Mr. GORE. Would you recommend that they try to build their own?

Mr. POTTS. If it is a small organization or even a medium size farm, the best approach is to get all of the available information, try to locate blueprints, and build their own system. Some of it you cannot build yourself.

Mr. GORE. Well, they have come to you for advice, and you are telling them, why don't you fellows see if you can find some blueprints?

Mr. POTTS. We are having blueprints developed. We hope within 2 months to have some decent blueprints that tell the folks, here is the best design we have available today.'

Mr. GORE. OK. We are seeing some rapid developments. In 30 days Farmers Home is going to have guidelines sent to its local offices on financing; and in 60 days DOE is going to have blueprints available.

We do have companies that are running to get units on the market. I take it the answer was affirmative to that question. One or both of your Departments are going to certify those units for on-farm use, when they are ready to be marketed; is that right?

Mr. WILLIAMS. What I would prefer we do is when the blueprints come in from a farmer through Farmers Home is to get a signoff on that original operation that it is technically feasible, that the energy balance is positive, and it is the best unit that we can make the loan on.

Now, that does not mean on every future unit that is similar or the same, that we would go to DOE. That is a bottleneck we ought not to have to deal with. If they approve the package plan that we can monitor and make loans on, we will go with it.

Mr. GORE. Mr. Potts, are you prepared to do that?

Mr. POTTS. Yes; we are. I have today fine staff people on board working in the Idaho National Engineering Lab and field office. We believe we are ready to begin technical evaluation of projects which come in to us, and we have offered, as I understand yesterday, to Mr. Williams, to begin that process with them at their request.

Mr. GORE. Thank you all for your testimony.

Mr. OTTINGER. I would like to have for the record, but would like to have in my hands today, if possible, a breakdown of that $30 million request.

Can you do that today all right, Bennett?

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Dr. MILLER. I don't have it with me, Mr. Chairman, but will try to get it.

[The information follows:]

FISCAL YEAR 1980 SUPPLEMENTAL REQUEST

[Dollars in millions]

	Presently available		Revised estimate		Proposed supplemental	
	Budget authority	Positions	Budget authority	Positions	Budget authority	Positions
I. Alcohol fuels	$11,500		$41,000		$29,500	
Program components:						
R & D					23,500	
Environmental research for national gasohol program					2,500	
Information programs					500	
Education and training programs					500	
Alcohol use in diesel engine					500	
Alternative fuels utilization					500	
Program Direction/Support					500	
Total	11,500		41,000		30,000	23

Mr. OTTINGER. Mr. Anthony.

Mr. ANTHONY. On the development of the blueprints, is it possible the farmer can come in and pick up a set of blueprints from Agriculture and go to DOE and have them say, "We are not going to give you a Farmers Home Administration loan because we did not approve these plans"?

Mr. WILLIAMS. Mr. Anthony, I would have no hesitancy in signing off. The Farmers Home Administration loaned out $14.6 billion last year. The second question that has to be asked is, if the plan is feasible, then what are the economics? The farmer is going to have to demonstrate that he has some way to market or use what he wants, and up to the money available, some $110 million in 1980. We intend to make alcohol fuel loans.

Mr. ANTHONY. The point I am trying to make, are you developing the in-house cooperation between the two agencies so that the farmer will not be used like a ping-pong ball and batted back and forth from one agency to another with one agency saying we did not make the rules and regulations and we do not go along with their thinking.

The farmer will get so discouraged that you will not get anything because they will quit and go back to the house and do something else.

Mr. Potts.

Mr. POTTS. I would like to respond to that. I would suggest, sir, that we have already agreed with the Department of Agriculture to provide the technical reviews of any plans brought to them. We feel very strongly the primary responsibility for on-farm financing should lie with the Department of Agriculture. We think our best area of production technology and expertise will reside in the area of from about 1 million gallons a year up to 30 to 50 million gallons a year. I would hope the situation you describe would not occur. Right now, we are advising the public of every program available

in Washington and the procedures that must be followed. I would hope we will not have that problem.

It may occur once or twice, but we will work not to have that occur.

Mr. ANTHONY. If one farmer comes into your office, you give him all this information. The information that you give him, it is for a small on-farm-scale use. He will actually be directed to USDA; is that correct?

Mr. POTTS. Our plan now is to inform the public as to what we have available in funding today. In USDA, there are several programs. There are also several other programs listed in the booklets we have here today, where a farmer could go for information. It looks as though the SBA would be the only agency with any substantial source of funds available to the farmer at this time.

Mr. ANTHONY. At what point do you not send them to USDA but you tell them DOE is going to take care of you, sit down, let us help you? How many farmers will it take to get together, and what size unit will they be talking about? And what type business venture before they go to DOE? I do not think that has been made explicit and clear. I would like for you to do so even if you have to respond in writing.

Mr. POTTS. If we have a plant for 1 million gallons of capacity or less, we would direct them over to the Department of Agriculture. We have some details we have to work out between the two agencies first. We are working on that right now. In general, to us, a plant which is of a million gallons or less in capacity would seem to us to be the size, that while we would be interested in them, USDA should finance them on farm. However, we have interest in plants ranging as low as 10,000 gallons a year. Already there are at least 50 projects in this country today that are there because of the interest and technical advice and assistance and encouragement we in DOE have provided. Most are small projects. I would suggest that we do not now have funding, as you know, for many, many projects. Under Public Law 96-126, we have $100 million in feasibility studies, $100 million in cost-sharing agreements, $500 million in loan guarantees, and $1.5 billion in price and purchase guarantees. This does not exclude the farmers, and we do expect to have farmers come through and talk to us in many cases. We would very much like to have the Department of Agriculture as an adviser in rendering assistance.

I think we have some further work to do between the two agencies before I can answer your question more thoroughly.

Mr. ANTHONY. Based on your comment, again you may want to respond in writing for the record, on page 6 of your testimony, this is Mr. Miller's testimony, you talk about the share of money to be spent on alternative uses will be determined after the solicitations have been evaluated.

I am extremely interested in what funds are available from DOE and other sources for the Gulf project testified to earlier by Dr. Frederickson. If you would specifically address that letter to me, I would like to know what moneys are available today and what moneys may be available in the near term for a demonstration plant utilizing the process testified to which is under way at the University of Arkansas.

[The information follows:]

On August 16, 1979, the Gulf Oil Corporation donated its biomass technology for converting cellulose into ethanol to the University of Arkansas Foundation.

The Department of Energy is working with SERI (Solar Energy Research Institute) and the University of Arkansas to make use of the technology to continue the research and development of utilizing celluiosics as a feedstock for chemicals production. DOE is currently in negotiation with SERI to forward $1 million dollars for the alcohol demonstration plant at the University of Arkansas.

Dr. MILLER. We have a proposal; we got one some time ago. It was not adequate for our funding process. We went back to the university. We have another proposal in-house now, and we are working on it.

Precisely what funds will be made available will be determined by what the request is and how it fits in with our overall authority.

Mr. ANTHONY. I would like to make this point: It appears this particular process has little possibility of going down the road to small-farm-scale use, whereas the other processes that we have been talking about, that is exactly where they get their start, on-farm use. It has now escalated up.

It would appear to me an equitable breakdown of those moneys should take that fact into consideration.

With that, Mr. Chairman, I thank you.

Mr. OTTINGER. The time of the gentleman has expired.

As I understand it, that project is somewhat in excess of $20 million. Is that included in your budget?

Dr. MILLER. It is not that high, as far as I know, certainly not in terms of the request to us. It is not specifically included in the 1981 budget, because it was prepared prior to our receipt of that proposal.

Mr. OTTINGER. Is the request for that in the Department of Energy, Department of Agriculture, or both?

Mr. WILLIAMS. No. I went down and visited at the University of Arkansas and came back and met with Congressman Alexander and with DOE. At that point in time, DOE took the lead role in handling the project. We did not get involved. It is in DOE.

Mr. OTTINGER. Mr. Wolpe.

Mr. WOLPE. Thank you, Mr. Chairman.

I would like to clarify for a moment precisely what has been done by the Department of Agriculture in funding and assisting farmers interested in moving into this area. Precisely how many farmers have received any kind of assistance?

Mr. WILLIAMS. We will be glad to provide you a table of everything we have done plus the applications pending and also the economic analysis on those plants a year ago and what they are today. Because of the interest and newness of the program the number of applicants and gallons approved will be changing daily.

[The information follows:]

STATUS OF LOAN INQUIRIES AND APPLICATIONS FOR ALCOLHOL FUEL PRODUCTION TO THE FARMERS HOME ADMINISTRATION, USDA, MARCH 1980

(Dollars in thousands)

Stage	B & I			Farm			Total		
	Number	Amount	Gallons	Number	Amount	Gallons	Number	Amount	Gallons
Inquiries	74	(58) [1] $355,394	(48) 252,080	124	(9) 1,169	(38) 1,344	198	(66) 356,563	(86) 253,424
Preapplication	35	417,713	(34) 220,283	7	(5) 1,290	(4) 1,300	42	(41) 419,003	(38) 221,583
Application	19	72,645	(10) 23,550	6	658	(5) 352	25	73,303	(15) 23,902
Loans or guarantees	3	2,625	2,657	3	719	277	6	2,844	2,934
Total	131	848,377	898,570	142	3,336	3,277	273	851,713	501,847

[1] Numbers in parentheses indicate the number of inquiries or applications included in the dollar and gallon data

Mr. WOLPE. How many dollars have actually gone through the pipeline today and are in farmers' hands today?

Mr. WILLIAMS. Very few have gone out. Perhaps $2 or $3 million in loans, and guarantees have been made through Farmers Home.

Mr. WOLPE. How much?

Mr. WILLIAMS. The above table shows $2.8 million of direct and guaranteed loan.

Mr. WOLPE. How many farmers have been the recipient of that amount of activity? Have you any estimate of the numbers?

Mr. WILLIAMS. No, sir, I would not try to guess with you on it. I have no idea. I think it is very small.

[The information follows:]

There have been loans or guarantees made to eight farmers or groups of farmers.

Mr. WOLPE. What is the total authority within your Department that has been made available during the fiscal year?

Mr. WILLIAMS. $100 million in B. & I. and $10 million in small-scale. I would not say it is in this fiscal year that lending has been done. We have tentatively signed off on a $14 million project with Lamar, Colo., depending on the outcome of the feasibility study. We have made loans in B. & I. for $2 million.

Mr. WOLPE. What is the time frame?

Mr. WILLIAMS. Most of these were within the last 2 or 3 months. We made the loan on methane gas which was mentioned on one of the major TV stations the other night.

Mr. WOLPE. What is the amount of the DOE passthrough money which your Department has expended?

Mr. WILLIAMS. It is about $12 million, and the best recollection of reviewing that, there is some $10 million of it where decisions have been made on what it is to be used for. It is being managed by three different people for DOE: TVA, Arthur Young, a major accounting firm, and the Solar Energy Research Institute. We are asking now if they are going to passthrough the dollars, what the management expectation is, and what we are supposed to do in managing them. We are asking Forest Service and the others to sign off before we take over the management of the funds.

Mr. WOLPE. Any idea to what extent those dollars will be spent in the next fiscal year?

Mr. WILLIAMS. All funds have been committed and will be spent, and we will be asked to manage them and will not know what they are.

The Forest Service has gone down to TVA and worked with them in trying to lay down a program being managed by the TVA authority, but I do not know the specifics of those particular contracts.

Mr. WOLPE. You have heard what the response has been; how can DOE be obligating moneys which in fact were earmarked for expenditures by the Department of Agriculture?

Dr. MILLER. We have not obligated them. We are working with the Department of Agriculture to establish the memorandum of understanding that will allow us to pass that money through and allow them to manage it. I frankly am quite sanguine that we will solve that in short order. But it is a new undertaking for us and for them, and there are understandable difficulties in that process. But

that money has been clearly identified in our budget. We expect to pass it through, and I personally think we will solve it quickly.

Mr. OTTINGER. Have you a target date?

Dr. MILLER. It always seems to be next week.

Mr. WILLIAMS. I raised the issue with John Sawhill last night and he promised me he would get back to us immediately, and if there was some assistance we can give in helping them, we are prepared to do that.

Mr. WOLPE. What was the starting point of those negotiations? Would 2 years be an approximate time frame?

Dr. MILLER. It has been over a year.

Mr. WOLPE. Somewhere less than 3?

Dr. MILLER. Yes.

Mr. WOLPE. Closer to 2?

Dr. MILLER. The original was signed in October of 1978. The biomass program was growing so rapidly at that point that it has only been in the last year that we have been able to identify areas in which we feel USDA is, in fact, expert. We were not in an area where we understood all the issues, and it has only been within the last year that we understand precisely what it is we will be passing through.

Mr. OTTINGER. The time of the gentleman has expired.

Mr. WOLPE. Thank you, Mr. Chairman.

Mr. VOLKMER. Mr. Williams, I notice in your statement you said some things that I would like to know a little bit more about. In other words, as you know, there are certain crops better for alcohol production, better than others.

We grow sugar beets in certain areas of this country, and the question is, can sugar beets be grown in Arkansas, or should we use sweet sorghum?

Is there experimentation being done in land grant colleges in this regard? I am talking about what land can produce which crops, and what does that production do to that land?

Mr. WILLIAMS. We have done some things, depending on whether cellulosic conversion takes place. If you can find a way enzymes will break down lignin, we think the work done in Peoria, for instance, as to soil erosion, will be useful. Is that the kind of question——

Mr. VOLKMER. No; you missed it.

Where can some of my farmers find out whether they can grow sugar beets?

Mr. WILLIAMS. For alcohol? If you can convert sugar beets into alcohol in a more competitive way then corn, obviously you should do that.

Mr. VOLKMER. Is there anybody who can tell my farmer whether alcohol production would be cost effective with the plan they have? That is, the end result. Can you tell me which is the most efficient and cost effective?

Mr. WILLIAMS. I do not know who the person is, but if you will submit me the specifics of where the land is located, we can get the soil conservation map, we will tell your individual farmer what the best crop is for him to grow.

Mr. VOLKMER. That information is available?

Mr. WILLIAMS. We have the technical ability to make that analysis.

Mr. VOLKMER. We do not need further studies on it?

Mr. WILLIAMS. The problem you have is if you are talking about grain, it is one type of process, and if you are talking about cellulose, it is another process. We do not see cellulose as being acceptable until enzymes break down lignin.

Mr. VOLKMER. Do you foresee any change in crops because of alcohol production?

Mr. WILLIAMS. Yes, sir, but I think the greatest potential will come when we can convert to cellulose rather than grain. That is particularly true in my part of the country, Southeast, we are already deficient in corn in the Southeast and we do not have the kind of corn land to go into alcohol. We would be better off raising another crop for alcohol.

Mr. VOLKMER. In this little pamphlet here, there is a statement on here, technical assistance. Where are we on our cooperatively trained technical specialty people, training the people so they are not fumbling their way as the rest of us are?

Mr. WILLIAMS. Part of that is going to be resolved when we get this booklet out to the Farmers Home Administration offices. When we do that, we will develop specialists in other offices as we start to answer specific questions. How quickly Extension will be able to pick up on that and take it forward I am not positive.

I have talked to directors over the country and we have talked about getting information out to the farmers so they understand the incentives as well as the pitfalls in terms of how you can use alcohol on your own farm. And second, with DOE as the lead agency, I think we have a tremendous resource in Extension in getting out information to rural citizens on conservation. They are gearing up for that kind of addition.

Mr. VOLKMER. We are looking at another year in time.

Mr. WILLIAMS. No; we are talking about in the next 30 days this pamphlet being made available. It will be similar to the DOE pamphlet on the last pages, questions you ought to ask yourself before you make the investment in alcohol fuel, how will it amortize in your particular situation, how much can you use, will you have the ability to move in from on-farm use to be able to participate in the 40-cent tax credit?

Mr. VOLKMER. On the loans and loan guarantees out of the $100 million from Farmers Loan, what is a maximum?

Mr. WILLIAMS. At the present time, the largest I have seen come through the system is $14½ million. It principally was dealing with methane gas from animal waste.

Mr. VOLKMER. How come my office in Columbia told us the largest loan was $250,000?

Mr. WILLIAMS. If it is a small-scale organization——

Mr. VOLKMER. No; I have people in my district who want to go to $2.5 million. They have a grain elevator right next to them and everything, and we contacted Farm Loan and they said the most they could lend was $250,000.

Mr. WILLIAMS. B. & I. has $100 million set aside and it does not have a cap set on it. They are eligible to go into the B. & I. industrial lending program.

Mr. VOLKMER. Thank you very much.

Mr. OTTINGER. Those are good questions. I wish we had more time.

I just have one question for you, Mr. Williams. We do not get the Department of Agriculture here very often, so most of the questions have been for you.

Senator Bayh suggested this morning that we ought to be thinking in terms of discontinuing exports to Russia or elsewhere of corn and grain and think in terms of exporting to them the distillates from grain after we have taken the alcohol out.

Is that in the thinking of the Department of Agriculture at all?

Mr. WILLIAMS. Yes, sir. It has not been a distinct policy of USDA, but, for instance, the major producer of the 80 million gallons of alcohol last year was Archer-Daniels-Midland. They make corn oil out of each kernel of corn; they make a glutinous meal, the largest of the byproducts, which is shipped exclusively to Western Europe; and they make a 60-percent glutinous meal used principally in the dogfood industry; and some food protein. Their other byproduct is alcohol, which they have been using in the States principally where they have had a higher subsidy than what we have had nationally.

Mr. OTTINGER. I want to thank you very much for your cooperation with us. We will maintain our interest in this, and I do hope that agreement can be concluded in the next week.

Mr. WILLIAMS. We would like very much to be through with the entire process. We are trying to make our recommendations along the lines if DOE is given lending authority. At the present time DOE is not in the lending business, and this is a decision we are not debating with the Department of Energy at all. What we are debating is if you are going to take additional resources from the windfall profits tax, how should the split and lending be done, whether it be on the feedstock, size of operation, or what.

The other point I hope the Congress will not omit is that I feel strongly that every agency in the lending business on alcohol or biomass products ought to have the same terms and conditions so we do not get people shopping between agencies on interest rates and terms and conditions. Mr. Sawhill agrees with that, also.

Mr. OTTINGER. Thank you.

Mr. VOLKMER. This is a Department of Energy book [indicating]. USDA is going to have their own.

Mr. WILLIAMS. Similar to that.

Mr. VOLKMER. When will that be out?

Mr. WILLIAMS. Within 30 days.

Mr. VOLKMER. Will you furnish a copy to my office as soon as it is?

Mr. OTTINGER. Mr. Miller, we are concerned with the number of personnel. What is being done to provide an adequate staff to be able to move out on the overall biomass program?

Dr. MILLER. Biomass totally?

Mr. OTTINGER. Both.

Dr. MILLER. Let me deal with biomass.

Mr. OTTINGER. I understand the alcohol fuel program had six, and Mr. Potts had nine, and biomass has three professional members.

Dr. MILLER. As we had originally stated a year ago, we had six people in biomass we wanted to bring on board.

When the Alcohol Fuels Office began to materialize as a real viable organizational unit, I took three of those people and assigned them to alcohol fuels. Yes, we are going through some strain at the moment, but we have six vacancies that are now classified and for which we have advertised, and we will bring these six additional people into the biomass program. It is a tough program, but with the growth of the alcohol fuels effort, we have had to provide those resources as best we can.

Mr. OTTINGER. Is there going to be a supplemental request or something? To create a national program where it is necessary to go to 500 million gallons by 1981, it would seem to me you would have to have a substantial effort. You would have to have an office of 140 to 150 people working on different aspects, because there are so many different ramifications to be pursued.

Dr. MILLER. Generally, the way we approach this problem is to recognize that the headquarters operations is usually singularly ineffective in dealing with highly detailed decisions that have to be made on technical programs. What we have tried to do is decentralize the technical work out to the field where it is actually performed.

We continue to follow that as an operating principle.

Mr. OTTINGER. How much staff is SERI devoting to these programs?

Dr. MILLER. I guess there are about 10 people at SERI in the biomass program right now. I don't count them as Washington staff, but I do count them as available resources.

With respect to the work at the Alcohol Fuels Office, none of us know the amount of effort that is going to be required. If it turns out that the resources that we presently committed are not up to the job, we will find more. There are a lot of people in the Department of Energy, and I think the commitment has been made clear by the Secretary, and we are going to find the people that we need to find to get that job done.

Mr. OTTINGER. Is there a specific program designed detailing how you are going to get from the present production of about 80 million gallons of alcohol to 500 million by 1981?

Dr. MILLER. There is not a road map.

Mr. OTTINGER. Hadn't there better be one?

Dr. MILLER. Yes, and that is what Steve is going to be spending a fair amount of his time on.

Mr. OTTINGER. If you only put incentives out and hope that the goal happens; I don't think that will be sufficient. A significant amount of coordination has to take place with the Agriculture Department in building the distilleries and creating the markets.

I am talking about getting the existing technology to the people. It seems to me that we are going to have to define who is getting into the alcohol business and where you may be able to bring in additional technology to benefit them.

Mr. POTTS. We have now authorized in my office 15 people. I have been able to pull in 9 since last Friday, and we have staff members working on the specific problems that you were discussing. We have someone researching what is going on throughout

America in alcohol fuels from the very small scale to the very large scale.

We have people who are going to research what is going on in the fabrication industries, the distillation, fermentation and systems builders, and I would like to correct something that Secretary Williams said a moment ago.

We are in the loan guarantee business as of the time Public Law 96-126 was signed. We want to be able to stimulate this industry as well as the rest of the synfuels industry.

We are laying the groundwork right now for the planning process which you described.

Mr. OTTINGER. How long a time do you think it will be before you give us at least a draft of a plan?

Mr. POTTS. I would like to say one thing. I think this is an industry that we can overplan. With the explosive growth in this industry we have attempted to determine how large the President's program should be, to find out what was going on around the industry.

We placed phone calls all over the country virtually 24 hours a day for 3 days to find out what was happening in synfuels. According to our phone contacts, in the country today in small-scale onfarm production, there is about the same capacity for alcohol fuels being built or under contract for completion in 1980 as there was extant in the entire industry for 1979. That is happening in small-scale growth. So it's an explosive growth we are having.

You are seeing large firms begininng to convert distilleries to come back into operation to produce fuel alcohol. We will be working on the plan for our process. My commitment right now is for 90 days. I would hope by the time the 90 days is complete, I will have an acceptable plan in being.

Mr. OTTINGER. I don't mean that we ought to be controlling what goes on in this area. I think that the goal is modest compared to what we saw actually happening in Brazil, I just don't see all of those essential parts being thought out and put together very well.

You could end up with a major catastrophe. I think that if we are going to have the kind of rapid acceleration that we are talking about, somebody is going to have to be watching to see what the needs are; look down the road three steps, and say, hey, if this isn't going to be successful we are going to need certain equipment. We can then direct some of the incentives that you have available to meet that particular need.

I hope that is the kind of thing that you will be putting together to make sure that when this all comes out in the end we don't have disruptions or a lot of products sitting around without a market.

Mr. POTTS. That is the approach we are trying to take. There are two professionals now on detail. Mr. Bill Holmberg has been instrumental in this. He is working the small-scale farm process to find out what is going on, and he is working on our interdepartmental processes.

Dr. Howard Coleman has been a deputy in the solar program area and is very experienced in industrial processes. In fact, he is a registered engineer. He has tremendous industry expertise. He is going to be looking at the industry itself in the fabrication areas.

We are looking right now for someone who is an expert in financial systems to become a specialist in loan guarantees.

Before any of this can really move we have to be able to have good solid loan guarantees in place. We are working on getting that done.

We have a person with us now who has been in the planning systems program at NASA and with the Department of Energy, and he is helping us put together a plan for our office.

Mr. OTTINGER. Have you got somebody on the agricultural side who is going to be sitting in the Alcohol Fuels Office?

Mr. POTTS. We plan to ask them to assign someone to us in the very near future. We want to have somebody who understands the policies on their loans very well.

We do have a tentative offer from TVA, but we have to execute some final agreements. We have, as you know, discussed an agreement that we are very close to signing with TVA.

Mr. OTTINGER. What happens after the 90 days?

Mr. POTTS. My task is to staff the office, organize it, get it running, get the process in synchronization and hire as many people as I possibly can in the time available.

Mr. OTTINGER. When you leave, will all of these other people leave?

Mr. POTTS. I would very much like to ask several of those people to stay with me. They came with the understanding that they will be with me for 90 days. If it works out, they will be asked to stay with us. We have to do all of the bureaucratic processes that any office has to do to get established.

We have to get our position descriptions and mission and functions statements, and we will be doing that.

Mr. OTTINGER. I have some idea of what that involves. I am glad it is being done on that kind of an expeditious basis. Of the $200 million available for loan guarantees and other functions under Public Law 96-126, do you have any idea how much of that will be devoted to the alcohol fuels program?

Mr. POTTS. No; we do not. I am caught in a bind on that issue. As in my other job, I strongly advised that we allow the entire community to compete on an equitable basis for that funding. I am now in a position where I would like to see as much as possible go to alcohol fuels. I can't tell you how much we will have.

Mr. OTTINGER. You are almost going to have to have a division, because the synthetic fuels from coal or oil shale are much further down the road, so that there is no way you can really compare that on a national needs basis.

A policy decision really has to be made. You are not going to be able to say methanol from coal looks much more attractive, we will put all our loan guarantees on that.

Dr. MILLER. I think we have put in place a reasonably elaborate mechanism to insure there is an equitable distribution of funds. There has been a task force in place for some time that has established a way of reviewing all of those proposals and sorting them out by technology, making recommendations on what the mix would be, sending that up to my level where again I and my counterparts across the agency will review it, and then we will go to the Under Secretary ultimately for disposition.

There has been a clear recognition all along of just that problem, and it is not as if we are unaware of it. There has been built in this whole set of review levels in which all of the vested interests, so to speak, will have a chance to argue further.

Mr. OTTINGER. They are there. I would hope that a policy distinction is going to be made here that you will have adequate funding to get this program running, that alcohol is a here and now kind of thing, and that there will be an adequate amount of money.

If you need more, come back to us. We might be able to pursue the longer term goals.

Dr. MILLER. Both Steve and I feel confident that there are going to be a fair number of really solid proposals in this area, not just in ethanol but all renewables, and we are going to fight very hard to have the decision made to fund those.

Mr. OTTINGER. All right. If you need help you got it. I am very interested in knowing in terms of the fiscal year 1981 budget which projects are available with promise at the pilot testing stage that we could get, or start to get in the field this coming fiscal year.

There apparently is a project in Arkansas and a couple of hydrolysis processes that look promising.

How much of that is in the fiscal year 1981 budget, and how much could we actually get in the field on a demonstration basis?

Should we, for instance, do something in hydrolysis where apparently they have a successful process going?

Dr. MILLER. In the biomass program over the past couple of years we have concentrated our efforts primarily on the wood or cellulose to ethanol process. We had significant programs in enzymatic hydrolysis, and acid hydrolysis and other more innovative techniques.

I think there is still a fair amount of work that needs to be done before we will see any of those in the field. In fact, we went through a competitive procurement last year which ended up in a decision to set up a test facility at Georgia Tech which would evaluate those processes and move to the process development unit stage.

The gulf work has been very exciting, but I don't think any of us quite believe that that is ready for mass production or even for building it up into a big commercial unit. It is a touch scientific problem, and I don't see anything at the moment to accelerate it.

Mr. OTTINGER. They have wanted money for some time to put up an investment plant.

Dr. MILLER. I see nothing there that says we have progressed past the processing phase.

Mr. OTTINGER. The 1981 budget proposes an ethanol from biomass production project at a cost of $2.5 million. Is this going to be an advanced hydrolysis unit?

Dr. MILLER. I draw a blank on that. I will be glad to go back and take a look.

Are you sure that is not the Georgia Tech facility? That number sounds right. I will go back and check that.

Mr. OTTINGER. The authorization for fuels and transportation item had an operating expense cut of about $1 million. What is the reason for that cut?

Dr. MILLER. That is in Maxine Savitz' side of the house. I can't answer that. With the new emphasis on alcohol we are going to

take a hard look at what we would do in the way of utilizing the capability over there.

Mr. OTTINGER. The project to which I referred before is in the construction project data sheets, energy supply research and development; plant and capital equipment, solar technology: Title and location of the project is "Ethanol from Biomass Production/Conversion System," location to be determined, project No. 81-T-305.

The work is scheduled for the second quarter of fiscal 1981, current $2,500,000.

Does that help?

If not, you can supply it for the record.

Dr. MILLER. I would like to go back and check that. I just don't have the figures.

[The information follows:]

The Ethanol from Biomass Production/Conversion System, Project No. 81-T-305 is for the design and construction of an integrated fermentation facility to produce ethanol from biomass. The unit will produce 2,000,000 gallons per year of ethanol from biomass, specifically grown for that purpose. The facility will incorporate the latest, readily available innovations in pretreatment, fermentation, and distillation processes. It will use a suitable fermentable energy crop using the latest production and harvesting technologies and will utilize the latest in fermentation technology.

It should be noted that since the creation of the Office of Alcohol Fuels, we have been revising the program to be as responsive to near-term alcohol production as possible. We have completed identification of the baseline programs for fiscal year 1980-81 and are finalizing the line items in terms of locations and application to determine if reprogramming will be necessary.

Mr. OTTINGER. In distilleries technology, is there new technology that is being used elsewhere in the world that we could demonstrate in fiscal year 1981 for use in the United States?

Dr. MILLER. There have been some representatives about new technology. Nothing that I have seen or heard says that we are not aware of what is going on, or that there are significant breakthroughs, and I don't see anything that says that we have missed the boat any place along the line.

Mr. OTTINGER. I was particularly interested in a Swiss process that I was told about, Chemapec.

Dr. MILLER. As I understand it, that is basically, an acid hydrolysis process.

Again, I am giving you my own understanding of the situation. I don't know of anything that is so dramatically new. Acid hydrolysis is head and shoulders above everything else. There may be some small increases in efficiency, but not very many major changes.

Mr. OTTINGER. Dr. Radovich indicated some alternative processes, the Fischer-Tropsch process, and so forth, all of which, look more promising economically, though they are not presently available.

I think we need to look and see what effect that is going to have on this ethanol process. If in fact we substantially subsidize ethanol, which we are doing at the present time, and we knew that next year some kind of gasification process was much more efficient than those studies indicate, then we certainly have to think out what we are going to do.

Are we going to perpetually subsidize the ethanol production? That is one of the problems.

Should we make those investments?

Dr. MILLER. Mr. Ottinger, it is one of the more thorny problems that we deal with from the Federal side. As we put R.&D. dollars into new processes that begin to succeed, there develops a reluctance on the part of industry to move with the older technologies for very good reasons, just the ones that you said.

If we want another year, maybe we will be able to pick up on those new technologies.

Why should we increase in the old ones? I have a feeling we are going to run into some of that.

Mr. OTTINGER. Do we have anybody looking at the time scale in which we can expect some of those other processes?

Dr. MILLER. We do that continuously in the present biomass program, and Mr. Potts, I am certain, is going to have his hands full in that area as well. He is going to have to know what is going on to make that assessment.

I certainly cannot cite precisely what the status is of all of those technologies. We have moved into it very rapidly, and I don't have all of the information.

Mr. OTTINGER. As much as I am concerned about the overproliferation of studies, I have a feeling we better have somebody take a look at the timeframe in which those different technologies are likely to kick in.

I keep getting signals that various methanol processes are going to be so much cheaper and so much more promising than existing processes.

I don't see them happening or going into the marketplace. I see a lot of people talking about it. We have had some proposals for research to the Department of Energy. Somebody better take a look and get some idea what timeframe some of these other processes are likely to come into being, so we really know what we are doing in terms of subsidizing existing technology.

We ought to move ahead with existing technology. The need is just so great that we should produce ethanol from agricultural products, in a big way. However, we better go into it knowing what is going to happen to the people that are going to be holding the bag when the new technology comes in and to see if it is possible to have some of them transfer the new technologies.

That is a study that probably would be worth making.

Dr. MILLER. I agree with you.

Mr. OTTINGER. Thank you very much.

The subcommittee stands adjourned.

[Whereupon, at 12:50 p.m. the Subcommittee on Energy Development and Applications of the Committee on Science and Technology adjourned.]

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